THE

ELECTRICAL REVIEW.

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ELECTRICAL REVIEW.

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THE

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AN OVERCROWDED PROFESSION.

JUDGING from the correspondence and advertisements in our own columns, as well as in those of some of our engineering contemporaries, it would appear that it is becoming increasingly difficult for technically-trained men to obtain employment.

Some of the correspondents blame the technical colleges for not giving the right kind of training; others blame the employers for an apparent failure to appreciate the higher value of a technical college graduate, as compared with that of the man who has merely served his time in the shops or drawing office.

If the latter be a valid complaint, then our manufacturers' practice is at variance with their preaching; for they have for the last few years been agitating for more and better equipped technical colleges, arguing that Germany and America are forging ahead of us in all engineering and technical industries by virtue of the superior facilities and higher standard of scientific training to be obtained in their Polytechnics and Universities. As a result of this ferment, we appear to be now erring on the other side, and somewhat overdoing the building of Technical Institutes.

We cannot think, however, that the complaint against the manufacturers is altogether justified, because several of our largest electrical manufacturers, in addition to most of the shipbuilding and engineering firms on the north-east coast, pay higher wages to apprentices who have successfully passed through a recognised course of technical training, than to those who have not qualified in this way.

We are inclined to think that some employers share the students' opinion that the nature of the training given is not always of the most serviceable kind. There is, perhaps, too much importance attached to the passing of exams., and the training given is directed rather towards this end than to teaching the students the application of general principles to some of the practical problems they are likely to be called upon to work out, after they leave the college; that is to say, if they are fortunate enough to get an opportunity of earning their living in the profession they have chosen.

Our technical colleges all over the country are turning out embryo electrical engineers by the thousand every year. A large part of the student's time has been given to the study of dynamo design, although the chances are that very few indeed will ever need to remember a single formula they learnt, and fewer still could design a satisfactory dynamo for any given output. It does not seem to be recognised yet that real dynamo designers form a very small proportion of the total number of electrical engineers; and now that sizes of motors and dynamos are fairly standardised, the proportion will be smaller still in future.

Again, a technical graduate would, without any hesitation, undertake to design an electrical railway system complete from the power house to the cars, yet he would fail if told to

get out an arrangement for driving a pump or a machine tool by motor.

It is said, and truly said, that you cannot teach a man experience. But it is equally true that an engineer with a long experience in the practice of his profession will prove a more valuable and more helpful teacher to engineering students, than one whose experience does not extend beyond the four walls of the college laboratory. This fact is well recognised in America, where professors are chosen for their practical experience as much as for their academic careers.

Even, however, if our technical college training were perfect, it appears to be the fact that the supply of electrical engineers has overtaken the demand, and they are now a glut on the market. An advertisement for an experienced man, at a salary far too low for the experience demanded, will call forth replies from scores, even hundreds, of men with excellent credentials, prepared to go to the ends of the earth in order to earn a bare living.

It is difficult to suggest a remedy for this state of things. It is not as though electrical engineering were the only overcrowded profession; all branches of engineering are in the same case, as are also the medical and legal professions. The supply of technically-trained men now far exceeds the demand, and the salaries obtainable for responsible positions are very often far less than those of the workmen occupying subordinate positions.

Is there a remedy? We shall be glad to hear what our readers think about it.

Coal Deposits v. Water Power.

Engineers frequently deplore the absence of large water powers in Great Britain, and some erroneously ascribe to this circumstance the slow development of electrical power transmission. We use the expression "erroneously" advisedly. Let us consider the case of the Glasgow Electric Tramways. During the year ending May 31st, 1905, 23,000,000 KW.-hours were delivered from their generating station at Pinkston. The fuel consumption amounted to 35,270 tons of coal at 6s. 5d. per ton. This works out at a fuel cost of 0·12d. per KW.-hour. The load factor was 31 per cent. For the previous year, with an output of only 15,000,000 KW.-hours, and doubtless a somewhat lower load factor, the fuel cost amounted to 0·15d. per KW.-hour. This is an excellent illustration of the possibilities associated with generating stations of large capacity, where coal is cheap and a high load factor may be maintained. With coal at 6s. per ton, a fuel cost of one-tenth of a penny per unit is already in sight. Thus, for large stations located at the pit's mouth, the fuel cost per KW.-hour delivered from the station should approach 0·08d. per unit for highly diversified loads with the consequent high load factor. This is a very small proportion of the total generating and transmitting costs, and represents the handicap of a steam generating station thus situated, as compared with a water-power plant of equal capital cost. But probably a comparatively small percentage of the large hydro-electric generating plants have been developed at so low a total capital cost per kilowatt for all the works associated therewith as is attainable in modern steam-driven plant, and the difference will often equal the capitalised value of so low a fuel cost as we have shown to be possible at the pit's mouth. Thus, so far as relates to the economic possibilities of electrical power transmission, Great Britain, with her present coal deposits and the present cost of working them, is not handicapped to any considerable extent, if at all, by the absence of water-power. The difficulty is to be sought elsewhere. In spite of the extortionate charges for transporting fuel, a power consumer can often buy coal delivered on his premises and generate his own electrical power, at a lower price than it can be transmitted to him electrically from the pit's mouth. This circumstance is not found in Italy and Switzerland, where electricity derived from water-power plants meets with no competition from coal at reasonable price, and where, as a consequence, it is true economy to develop water-powers, even when this involves a capital outlay so great that they could not be economically developed were they situated in a country like Great Britain, where coal is cheap.

Improvement in the prospects of electric power transmission in Great Britain is to be looked for, as has been pointed out by Mr. Addenbrooke, in reducing the costs of transmission, which will become a minimum when the generating costs corresponding to the loss of energy in transmission from generating station to consumer are equal to the interest and depreciation on the capital investment for the transmission system. In Great Britain a severe handicap is here encountered, due to the insistence of Governmental and local authorities on underground transmission lines. This limits the practicable transmission pressure to some 12,000 volts, and consequently necessitates an enormous investment for cables and a correspondingly high loss in transmission. Furthermore, a large portion of the capital investment is for perishable insulating material. These conditions ultimately so greatly limit the economic distance of transmission, as to tremendously handicap electrical power transmission in Great Britain.

The Instruction of Motormen and Conductors.

Whether it is that the Americans give more attention to the complete training of their tramcar employés than the British, or whether it is merely that they talk about what they do well more than we are in the habit of doing, is not a problem capable of solution without a better acquaintance with the actual facts than we can claim to possess. Certain it is, though, that the American journals occupy much more of their space with discussions and descriptions of the current methods of dealing with recruits than do our specialised traction journals.

The Electrical Review has spoken words in season—they never can be out of season—on these matters; and it is to be hoped that greater efforts in the direction of educating the recruits are being made since the first words were uttered. If the "goose step" be not mastered, how can a man be expected to march without breaking line? For their own sakes masters must teach the men who are to do their work, if that work is to produce the best possible results, and they should look to it that the period of education be sufficient, that the machinery for it is modern and in order at all times, and that the *media* of instruction are themselves fully equipped for their educational duties.

On all systems alike the car-shed, the repair shop and the road must be the greatest factors in the training of the motorman, but the larger systems can afford the means for more organised and special training. In any case, the trainers—call them what you will—must be picked and paid. By no means every man who has passed whatever tests bar the way to the unguided use of the handles is suited to give the key to others, and the unthinking manager who shoots a student on to the first passing car and allows him to take his instruction from all and sundry, is doing no good either to his business or his men.

These remarks have been prompted by a recent article in the *Street Railway Journal*, which describes, chiefly by means of reproductions from rule-books and examination forms, how the crews of the Brooklyn Rapid Transit are trained to the use of fare registers and controllers. A view is given of the school in which students learned the elementary movements—their goose steps—of the controller and brake before proceeding to practice on more lively subjects, and it is noteworthy that the scope of the technical instruction sought to be imparted is limited to an

unusual degree, although it is quite extensive enough when the mental calibre of the average recipient is considered.

The chief points about the Brooklyn system of education are that a student passes by steps to the assumption of his duties, and that his conduct at every one of those steps is duly recorded and filed. There appear to be five examiners and two other staff officials whose certificates are required prior to the final stage of six days on the road at part pay with an inspecting motorman, so that the man who passes all with flying colours should deserve his badge.

The article is commended to those who have not yet acted upon the thoughts which must have exercised them times out of number.

The Rigour of the Game.

We have often had occasion to criticise the proceedings of our scientific and engineering societies, and to suggest that time is wasted to a deplorable extent by the verbatim reading of the papers, to say nothing of the platitudinous nature of the discussions. The Institution which is especially associated with our industry is not the least offending, at any rate so far as the headquarters meetings are concerned, and we feel an envious chagrin as we read of the Röntgen Congress at Berlin the following remarks in the current *Archives of the Röntgen Ray* :—

> The Congress was composed of medical men, physicists, and technical electricians, some 500 of whom, from all parts of the world, were present. . . . Members of German nationality, however, were in the majority, and one was greatly impressed by the steadfastness and earnestness of their demeanour. From early morning till dark they sat with grim, set faces and unflagging attention. *No time was spent in unavailing compliment, or futile discussion, and paper followed paper with unfailing regularity. The vote of thanks—"this very interesting paper" business—which wastes so much time in our own societies, was dispensed with, and the scientific bore who is always producing "just one word more" from the depths of his ignorance, is apparently unknown in Germany.*

Oh, happy Röntgenists! When will the time arrive when a similar statement to that italicised by us will be applicable to our technical discussions?

Consulting Engineers' Specifications.

The letter from Mr. T. Scott Anderson, which appears in our "Correspondence" columns to-day, recalls attention to the much-discussed question of tendering for public contracts. On the face of it, our correspondent appears to have good reason for complaint. While we cannot withhold general approval of the action of the L.G.B. in the first instance cited, on account of the tendency so constantly observed for public bodies to incur extravagant and unnecessary expenditure of public moneys, our sympathies are with the firms who suffered inconvenience and expense thereby.

As for the practice of naming a particular firm to supply specified goods, this is rarely justifiable, and when the firm in question is neither the sole nor even the best maker of the goods, it becomes absolutely indefensible. It is the duty of the consulting engineer to make sure that his clients are enabled to purchase sound apparatus without incurring undue expense, conditions which cannot be fulfilled under the circumstances alleged in this case.

As for the second example, there appears to be evidence of undue favour. The consulting engineer owes a duty to tenderers no less than to his immediate clients; he is bound in honour to see that they all have fair play and equal opportunities. Unfortunately, the proud feeling of being in a position to patronise the contractor sometimes seems to be too much for the self-restraint of the engineer. Such instances bring discredit upon the professional class. The Electrical Manufacturers' and Contractors' Associations ought to be able to do a good deal towards mitigating, if not abolishing, these regrettable abuses of authority.

THE ELECTRICAL OUTLOOK IN JAPAN.

While the air is filled with the expressions of boundless admiration for the unparalleled achievements of our victorious ally in the Far East, and while all save the ultra-pessimist and the hypercritical are feeling gratified at the renewal and strengthening of the agreement between Great Britain and Japan, it will be timely if we devote a little of our space to the position of electrical matters in that part of the world.

It was but in keeping with the distinctive characteristics of the Japanese that they should display an early activity in the study and application of electrical science and engineering, but the enterprising spirit consequent upon the adoption of Western and American civilisation has also been accompanied by a very remarkable reticence on their part. Keeping the key turned in the door of the intelligence bureau was undoubtedly of immense assistance to Japan during the conflict, but it does not appear to be in regard to war only that the little-say policy obtains, for there seems to be little public information imparted by them relating to the position of electrical trading. The language may be an obstacle, for though English has been studied by many of the Japanese, either in this country or in America, few Englishmen seem to have found occasion to study the language of Japan.

Several of our leading manufacturing companies have made it their business to send responsible members of their boards or staffs in recent years to make a study of the markets there, but, naturally enough, these companies are not eager to impart to all and sundry, information which, at much expense and labour, they have sought for in the interests of their own businesses.

There is an interesting question as to the extent to which Japan will meet her electrical needs from manufactories erected in her own land. And another equally interesting question is the position of advantage which some consider America has secured by her early establishment there, and through many young Japanese engineers obtaining their technical education and experience in the colleges and workshops of the United States.

It is true that there are manufactories established or now planning for Japan, and that American traders and engineers are at the back of some of the principal ones; but we have all read enough lately about the enormous development which will soon be taking place to lead us to believe that there will be many substantial opportunities for British manufacturers, if they do not wait too long and if they go about the business circumspectly.

Indeed, from what follows later in this article, it will be seen that in several lines we already have an important hold upon the market, and we ought not to be slow in taking advantage of the favourable position in which we are placed, in regard to other branches of trade, especially electrical plant and apparatus.

It must, of course, rest with English electrical firms to analyse the position, each for themselves, and then to act promptly upon the conclusions at which they arrive.

We have made several efforts to obtain first hand and fully detailed information from reliable sources in Japan regarding the exact position of electrical trade and the prospects of the British manufacturer, but so far with little success. We have, however, had calls from visitors from Japan to this country, and our conversation has lingered upon the readiness of the Japanese buyer to deal with American houses, partly, we understand, because like the nigger, but with different experience, he has "bin dar," and partly because British manufactures are not kept to the front so well as they might be.

Our readers will have noted that the Electrical Review has during the last few years been able to publish a good deal of matter relating to electrical doings in South Africa, India, Australia and Canada. It need be no secret that, again and again, we have been congratulated upon this feature of our work, and these congratulations have come from those who have an intimate acquaintance with the particular Colony in regard to which they have spoken. But our readers can have only a small idea how difficult it is to get those of ability, connected with the electrical trade in the

several parts of our Empire, to set down in black and white the knowledge that is in them and would be of great value to us at home. And in regard to Japan it has been equally difficult.

A certain amount of information has appeared from time to time in the pages of certain of our trans-Atlantic and other contemporaries, but before turning to note what is contained in some of these, we may appropriately refer to an article published in the last number of the *Outlook* from the pen of Count Okuma. This authority in dealing with the work of economic development which lies before Japan in Korea and Manchuria — this is apart altogether from progress in Japan itself and Japanese operations in China — looks forward to the development of agricultural, industrial and mining enterprise in the regions where the war has been fought, and he advocates the fullest freedom of enterprise, suggesting that if Japanese forces are inadequate, Englishmen and Americans "should be called in as partners in the work."

There can be no doubt that our commerce will feel a sure measure of advantage from the existence of the Anglo-Japanese Alliance and current international sympathies, and it is certain that industrial and mining development must involve many demands upon electrical engineering, for there are few departments of engineering and industrial development nowadays that are not somehow or other and in some degree dependent upon the progress of electricity.

In the columns of our New York namesake several months ago, Mr. William Dinwiddie described the Shibaura Engineering Works, which is one of the two factories in Japan where the principal electrical manufacturing work is being carried out. Here machines of "respectable size," designed by Japanese engineers who were trained in foreign technical colleges, are manufactured by Japanese labour. At the Shibaura shops, we gather, the equipment, though driven by modern induction motors, was not by any means up to date, but, notwithstanding this drawback to cheap manufacturing, the Japanese were able to turn out electrical machinery for 30 per cent. less than the price for which American manufacturers could deliver similar apparatus in Japan. It should be added that the Shibaura Works are located at Tokio, and are a branch of the great Mitsui Co., of Japan, which now controls one-sixth of the foreign trade of that country.

The other factory is that of the Osaka Electric Lighting Co., and is located at Osaka. Both factories are less than ten years old.

Mr. Dinwiddie, writing of the former works, says that an explanation of the lack of special machines is to be found in the fact that most of the machinery for the production of electrical apparatus, &c., is patented and registered in Japan by the great manufacturing firms of foreign countries, and when they are not held for exclusive use, the royalties demanded make their employment almost prohibitive.

"Admitting this to be true, there must then be great opportunities in Japan for branch manufacturing companies of the corporations which control the specialised and patented machinery. Most of the machinery is of American make, and no particular firm seems to have been given a preference. The heavy machinery, such as shears, punches, and steam hammers, is of Glasgow manufacture, and in this connection let it be said, incidentally, the writer has noticed that the trade generally, throughout the world, usually buys its massive machinery in Scotland, in preference to the United States, and the answer to the 'Why' is often that it is more dependable, having less flaws in the castings."

Some small examples of Japanese electrical work—telephonic and telegraphic apparatus, continuous-current dynamo, a testing transformer for 150,000 volts—were displayed at the St. Louis Exposition last year. Fairly large machinery has been made there for some years past, and it was only the big distance to be travelled that kept the larger examples at home.

The Shibaura company furnishes complete electric plants for power and lighting, and it also installs them. The largest generator so far manufactured is a direct current generator of 373 H.P. for the Imperial Dockyards at Yokosuka, which has been in constant use for two years driving motors. The largest engine ever built is over 1,000 I.H.P., and this is in use in a cotton mill. A 20-ton electric crane built by the company, has been in use on the Nippon Railway for the past five years. From the same works also there were supplied three pairs of 120-KW. three-phase 3,000-volt induction type motor-generators for the Tokio Electric Street Car Co. In 1904 the company made 65 direct-current generators of 1,450 KW. aggregate capacity, and various motors, transformers and so on. Indeed, the catalogue of manufactures comprises almost everything that a large electrical and engineering factory in this country would turn out.

One of Mr. Dinwiddie's many interesting observations informs us that all copper wire is made in Japan, of copper from Japanese mines. The fibre insulation is also of home manufacture, but all the steel and iron plates and bars come from England, as well as most of the insulating materials—such as mica and asbestos. Some pig-iron is brought from England, but a large part of it is from Japanese furnaces. The iron and steel are brought from England, "because, so far, the United States has not been able to meet Great Britain's prices." Another direction in which England has the advantage is this :—"Though the difference in time of transportation of such materials to Japan is fully two weeks in favour of the United States, the railway tariff across America more than over-balances the cheap, slow all-water transportation from England." There seems to be plenty of cheap skilled labour available, and a 10-hour day is worked. May we quote two further extracts from this same author :—

"The great industrial future of Japan is assured for four reasons :—

"1. The workmen are naturally clever and skilful with their hands, learning their tasks easily and rapidly, and, though short in stature, they are heavily muscled and of robust constitution, which makes for sustained manual effort and maximum production.

"2. The immense population in a limited area, increasing annually over half a million souls, assures an abundant supply of cheap labour.

"3. The markets of the great Far East are at her very doors.

"4. She has an abundant supply of coal and copper at home—and probably also of iron." . . . .

"It will thus be seen that in a few years, with cheap labour and raw products at home, Japan will be in a position to compete with foreign countries not only for the electrical supply trade of the East, but she will enter the market for most of the manufactures of iron, as she is already in the China field with engines and boilers.

"However, that the home products of electrics have not yet become a serious menace to the foreign trade is evidenced in her import figures of these supplies. In 1900 she imported $150,000 gold worth of electric machinery, and in 1904 half a million dollars gold, of which latter sum three hundred thousand dollars' worth were purchased from the United States. As a matter of fact, Japan is only in her infancy, electrically, but with the many corporate lighting and power schemes now on foot and being discussed she may be expected to grow tremendously in another 10 years." . . .

"The mountainous islands, girt with narrow seaboards, offer wonderful possibilities in economical water power, but so far no attempt at long-distance transmission of electricity has been made with the single exception of a lighting and power plant at Hiroshima, on the Inland sea where a 10,000-volt current is carried 20 miles to the city. A 5,000,000-yen company has been incorporated in Tokio for the purpose of establishing a high-potential line into the city from the Katsura river falls some 40 miles distant. It is the intention to deliver, at the start, 10,000 H.P. at the Tokio end of the line."

Mr. Dinwiddie concludes by advising—as being more likely than dealing to bring the best return—the establishment of well-equipped and modern manufacturing plants in Japan itself. This is advice which, presumably, holds good for British firms as much as, if not more than, for our trans-Atlantic friends.

The New York *Electrical World and Engineer* recently gave some particulars of the equipment which had been ordered by the Tokio Electric Light Co. for its Tokio power

house. The installation will consist of the following apparatus :—Three 1,000-KW. Westinghouse steam turbine outfits, the generators for which will be wound for three-phase, 50 cycles, 3,300 volts, and will operate at 1,500 r.p.m. The exciter outfit will consist of two separate units, the first being a 100-KW. direct-current generator, direct-connected to a Westinghouse 12 and 20 × 12-in. compound engine ; the second unit is a motor-generator set consisting of one 150-H.P. polyphase constant-speed induction motor, wound for 3,500 volts, direct-connected to a 100-KW. direct-current generator, wound for 125 volts. The switchboard panels and framework are being built in Japan, but the instruments for these panels will be shipped from America, and will be of standard Westinghouse make, consisting of 48 type F ammeters and 26 type F voltmeters, with necessary auxiliary apparatus. The condensing plant is being furnished from England by Messrs. W. H. Allen, Son & Co., Ltd., each set of units consisting of an Allen patent condenser of 3,600 sq. ft. capacity, a 13 × 10 three-throw Edwards air-pump geared to an 11-H.P. induction motor, and a 16-in. circulating pump driven by a 47-H.P. induction motor operating at 220 volts. The boiler outfit is being furnished by Messrs. Babcock & Wilcox, of London, the smaller auxiliary machinery of the plant, such as travelling cranes, feed-pumps, heaters, &c., having been divided between America and Europe.

The installation was contracted by Messrs. Takata & Co., Tokio, engineers and contractors, who are also preparing to ship a large consignment of electrical apparatus for the Furukawa Western Bureau, one of the largest copper mining interests in Japan.

Another of our American exchanges (*Electricity*, of New York) has also been dwelling upon the electrical possibilities in this part of the world, and we extract the following observations on the situation :—

> Thirty-seven turbo-electric plants have been ordered by Japan, aggregating a total of 35,000 H.P., for use in Tokio and other large cities in her provinces. In lighting capacity the total would equal 400,000 lamps. In power equipment it speaks for itself. Electricity is being extensively used in Japan for both street and interior lighting. It finds a large and constantly growing application for many industrial enterprises.
>
> The street railways are forming a complete network under the stimulating influence of American and English capitalists. The networks are connecting town with town, city with city, the suburban with the urban districts. The great coal mines are on the point of undergoing a complete rehabilitation by the introduction of electricity for the drilling, carrying, lighting and ventilating of the mines.
>
> But when we discover in the manner of giving and handling franchises for public utilities, as in the case of her Tokio Street Railway, that in this instance the franchise provides that after 1932 the municipality may acquire the line by paying an adequate price for it, a certain Utopian spirit seems to appear, in marked contrast with the method prevailing in many other lands. In July, 1904, Japan received news of the first big shipment of turbines to her shores. Since that time American enterprise, more than any other, more even than her ally England, has erected power plants and installed systems that place her among the largest consumers of electrical devices we have. Geographical terms will soon represent less inherent national differences than differences in language or manners.

The figures that were issued by the Department of Finance at Tokio relating to the foreign trade of Japan during the year of 1904 should be recorded in our present study of the position. They show that both imports and exports had made an enormous advance during the 10 years commencing in 1895, and this growth was particularly large in dealings with both this country and the United States. The following figures were recently quoted in the *Society of Arts Journal* :—

> "The imports into Japan in 1904 were the largest on record, being £36,900,000 in value, as against £31,600,000 in 1903, £28,600,000 in 1900, and £13,300,000 in 1895. Exports from Japan in 1904 also established a new high record, being £31,800,000 in value, as against £28,800,000 in 1903, £19,800,000 in 1900, and £14,000,000 in 1895. Thus the imports into Japan have increased by £23,600,000, and the exports from Japan by £17,800,000. Japan imports most largely from Great Britain, British India, the United States, China and Germany, these five countries supplying about 77 per cent. of her total imports. Of the total imports into Japan in 1904, amounting to £36,900,000, the United Kingdom contributed to the extent of £7,400,000, or 22·2 per cent. ; British India (including Straits Settlements), £7,045,000, or 19 per cent. ; the United States, £5,800,000, or 15·7 per cent. ; China, £5,430,000, or 14·8 per cent. ; and Germany, £2,860,000, or 7·7 per cent. Of the exports from Japan, amounting to £31,800,000 in 1904, the principal countries of destination are the United States, £10,080,000 ; China, £6,770,000 ; France, £3,610,000 ; Hong Kong, £2,800,000 ; Korea, £2,030,000 ; Great Britain, £1,750,000 ; and Italy, £1,200,000, these seven countries taking about nine-tenths of the exports. The United States is by far Japan's best customer, exports to the United States from Japan representing about one-third of her total sales to foreign countries. The relative progress made by the United States and the United Kingdom in the import trade of Japan is seen in the following figures :—
>
> "In 1884 the United States supplied 8·4 per cent. of Japan's imports, while the United Kingdom supplied 43 per cent.
>
> "In 1889 the United States supplied 9·3 per cent., the United Kingdom 39·4 per cent.
>
> "In 1894 the United States supplied 9·3 per cent., the United Kingdom 35·9 per cent.
>
> "In 1899 the United States supplied 17·3 per cent., the United Kingdom 20·3 per cent.
>
> "In 1904 the United States supplied 15·7 per cent., and the United Kingdom 20·2 per cent."

A chatty article on the rubber industry appeared in the *India Rubber World* for March 1st, 1905, entitled "A Glimpse of Japan and its Rubber Industry," and in the course thereof it is stated that there are seven companies there engaged in the manufacture of rubber, and their names are as follows :—

Tokyo Gomu Seyzo Kaisha, the Meiji Rubber Manufacturing Co., Mitado Rubber Co., Nippon Rubber Co., and Fujikura Insulated Wire and Rubber Co., in Tokyo, the Yokohama Insulated Wire Co., in Yokohama, and the Osaka Jushi Sheizosho, in Osaka.

The editor of our contemporary, after personal study on the spot, observes :—

> Manufacturers in the United States often look askance at Japan, wondering what that country will be industrially when it fairly wakes up. From my own observation I do not think the rubber trade, at least, need fear Japanese competition for some years to come. For their own needs, they will doubtless soon make the most of their own goods, but when it comes to entering the markets of the world, they will be facing a different problem. The need of great numbers of workers skilled in rubber will be one that will not be easily supplied. The Japanese are exceedingly ingenious, marvellously industrious, but the cheap labour, cheap though it is, is not to be compared with the high-priced skilled labour employed in America.

A KENTISH BREWERY INSTALLATION.

THROUGH the courtesy of Messrs. C. N. Kidd & Son, we were recently enabled to inspect that firm's very complete motor installation at their brewery at Dartford.

The brewery in question is equipped with a 30 quarter plant, and some 16 480-volt motors are utilised for driving

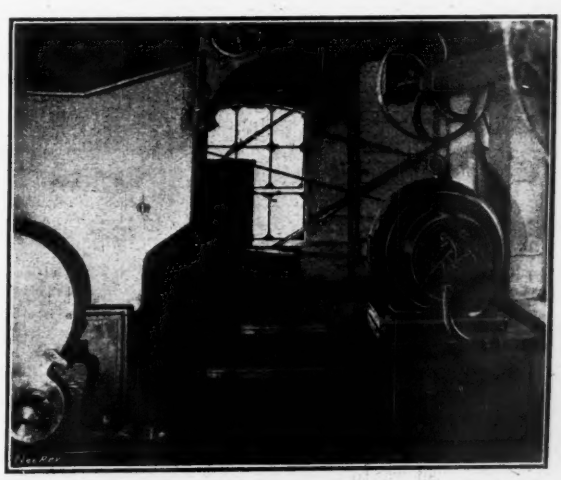


FIG. 1.—MALT MILL DRIVEN BY 15-H.P. MOTOR.

practically all the machinery in use, the energy being obtained for this purpose from the U.D.C.'s mains. The new installation has been carried out completely by the Langdon-Davies Motor Co., who also supplied the hoists.

In common with, we believe, the great majority of people, we must confess to certain haziness as to the processes employed in, if not to the products obtained from, a brewery,

and our visit was all the more interesting in that it demonstrated the cleanliness essential to such a process, an item which electric driving renders perfect.

Fig. 2.—Barrel Hoist Driven by 3½-h.p. Motor.

The Council's supply main is taken into the original engine room (containing a displaced 50-h.p. Galloway engine), the two outers being connected to a substantial double-pole distributing board, neatly enclosed with a glass door. A main switch with laminated contacts is provided to each bus-bar, and the motor circuits are protected by fuses of tubular type. The building is wired throughout in screwed iron tubing, and special precautions have been taken in earthing the latter.

Our first move led to the basement, where is situated a barrel hoist to lift some 7 cwt., driven by a 3½-h.p. shunt-wound motor, the switchgear here, as elsewhere in the building, being arranged beside the motor and consisting of two enclosed fuses, a double-pole ironclad switch and a motor-starter mounted on one base.

In the hop house, a 3½-h.p. compound-wound motor drives a 4-cwt. friction hoist for bringing in the hops and sugar, the hoist as well as the motor being supplied and erected by the Langdon-Davies Motor Co.

Coming to the brewery proper, a 10-h.p. shunt-wound motor is installed for working the rakes in the mash tun—practically the heaviest work in the brewery; the power being transmitted through belts and gearing. On the same floor a 7-h.p. shunt-wound motor drives a screw conveyor for emptying the used grains out of the tun, and a 1-h.p. shunt motor is also installed for driving sundry machine tools, &c. On the floor above a 3½-h.p. shunt wound motor drives a Steel's masher, the products of which fall into the mash tun; here it may be noted is arranged the switchgear for the above motor, and also for the mash tun motor fixed below; on a higher floor malt grinding and malt cleaning machines are operated from a 15-h.p. shunt-wound motor. The dust from the latter machine is collected in a "dust destroyer" near by, driven from a 3½-h.p. shunt motor. On the top floor is situated a malt cleaner driven from the motor below, and in one corner is arranged a 2-cwt. friction hoist operated by a 3½-h.p. compound-wound motor.

Our next visit was to the barley store, where 5-h.p. shunt-wound and 3½-h.p. compound-wound motors drive a barley-cleaning machine and a friction hoist respectively. The hoist and its motor were supplied by the Langdon-Davies Motor Co., and are installed in the roof.

In the malt house a 7-h.p. shunt motor operates a belt conveyor and elevator for distributing barley and malt between the upper and lower floors, and a further 8 h.p. compound-wound motor drives a malt lift on the top floor of the building. In connection with the barley-cleaning machine last mentioned, a dust destroyer is installed in the basement, driven by a 2½-h.p. shunt motor, and two 1-h.p. motors are utilised for working the bottling machinery.

From the foregoing it will be gathered that (with the exception of a deep-well pump) the whole of the brewery machinery is electrically driven; no records of the actual motor load are obtainable, but under present conditions, with energy purchased from the U.D.C., the cost is much less than formerly, as the following figures for the six months ending June 30th, 1904 and 1905 respectively, show :—

1904.—Steam Driving.		1905.—Electrical Driving.	
430 tons coal ...	£369 11 6	349 tons coal* ...	£201 6 1
Liquid fuel	24 15 6	Liquid fuel... ...	27 9 4
	£394 7 0		£228 15 5
		Add cost of energy from U.D.C.'s supply at 2½d. per unit, less 5 % ...	19 6 8
			£248 2 1
		Two men at £2 13s. weekly wages replaced by one lad at 13s	

* Original Lancashire boilers in use for supplying steam to brewery; smaller boilers would show greater economy in coal.

During the four or five occasions per week when brewing takes place, some three or four motors only are in use at one time, while formerly the 50-h.p. engine and sufficient boiler

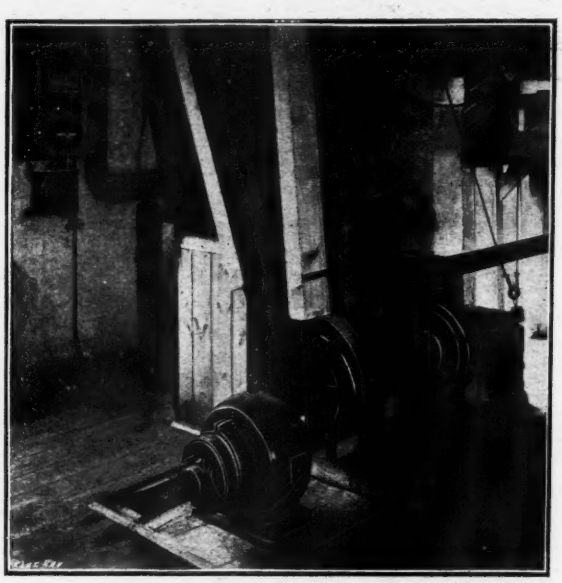


Fig. 3.—Motor-Driven Friction Hoist with Starting Switch, &c.

power to drive it, were necessarily kept in readiness. The whole of the motors are neatly boxed in, and the majority of the switchgears are arranged in cupboards. We gather that during the seven months in which the installation has been working, no trouble has been experienced with it.

LAMP INSPECTION AND TESTING ON A LARGE SCALE.

In a paper read before the Iowa Electrical Association,* Mr. L. B. Spinney emphasises the advantages which are gained by the municipal engineer, who, in addition to the careful consideration of the efficiency of his electric generating plant, pays some attention also to the efficiency and uniformity of the lamps installed throughout his district.

Just now, when the municipal authorities in this country are beginning seriously to consider the system of lamp control adopted in the States, the subject of lamp testing becomes of increasing interest, and the importance of ensuring good efficiency for this last link in the chain of energy transformation should hardly need urging.

* *Municipal Journal and Engineer*, Vol. XVIII., No. 4, April, 1905.

As is now generally known, the central station engineer in the States not only undertakes to supply energy to his customers, but agrees to supervise the efficient transformation of that energy into light; realising that the sale of his energy and the adoption of his system of lighting depend largely on the extent to which his customers are satisfied with the brightness, constancy, and cheapness of the illumination with which he supplies them.

In this country any general system of lamp inspection is practically non-existent, and this enables manufacturers, if they be careless or unscrupulous, to supply lamps which would fail to pass even the most superficial tests, so that the subject has become one of urgent importance, and municipal engineers and others are now doing well in turning their attention to it.

For many years past the leading American supply companies have had in full working order a lamp-testing laboratory, which undertakes to inspect and report on all consignments of lamps supplied to them, and it can be readily understood how the establishment of systematic testing in this way has raised the standard of manufacture and

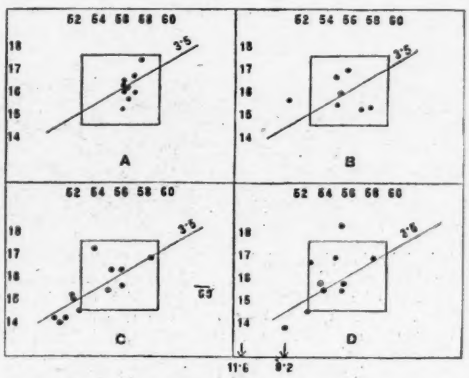


Fig. 1.

ensured uniformity in the quality of the lamps sent out by these companies. The better class of manufacturer welcomes such an inspection, since its effect is to expel from the market the cheap and badly made lamp, which can only gain a sale on account of the inability of the purchaser to test the sanguine statements of the vendor.

The first question to be considered in the inspection of a consignment of lamps is their uniformity in rating in watts per candle and also in candle-power.

Provided the efficiency, or, in other words, the intrinsic brightness at which the filaments are run, is uniform, a batch of lamps will also have a uniform rate of fall in candle-power during their life, and it can be estimated very approximately when lamps in a given district should be changed. The

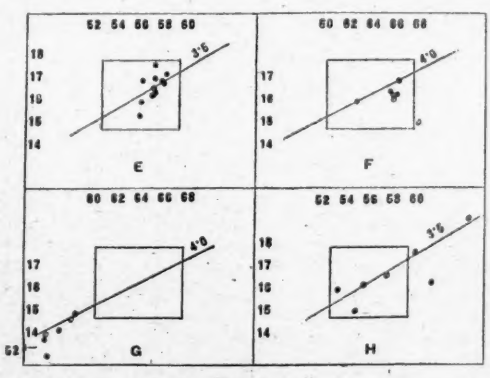


Fig. 2.

object of this is to ensure that they shall not be left in circuit until they are burnt out—a practice entailing inefficient lighting and the dissatisfaction to customers which accompanies the use of dim lamps and large bills.

In his paper Mr. Spinney gives some interesting diagrams illustrating well-rated and badly-rated lamps as received from different manufacturers. These are in the form of the well-known target diagram (figs. 1 and 2), in which candle-power is plotted vertically, and watts per candle horizontally, so that each lamp out of a batch of, say, 20 is represented by a dot somewhere on the paper. The square in the middle shows the limits of variation allowed in candle-power and watts per candle, so that, if properly rated, all lamps should fall within this square. A casual inspection of these diagrams shows at once which lamps have been properly rated, and will also serve to show what wide variations may occur in practice unless careful supervision be made.

In fig. 1, A shows properly-rated lamps, while B, C and D show other batches, out of which some units were found to be outside specification. The dot with the circle round it, in the centre, is the average of the whole batch and should not be more than a certain percentage amount from the specified values of candle-power and efficiency.

It is often noticed that different consignments from the same maker vary considerably in quality, so that it is essential that these testings go on continually, and the average of a year's findings be taken, when forming a judgement of relative superiority. It would, of course, be out of the question to test every lamp supplied, but a large enough percentage should be taken at random from each case to form a guide to the performance of the remainder, and upon which the whole consignment may be either accepted, rejected, or, if nearly within limits, submitted to further tests.

The initial rating of lamps, although important, is not by any means the only point to be considered in this connection.

The length of life and rate of diminution of candle-power are equally important, and tests are required which will be some guide to the performance of a consignment of lamps during their life, and to the relative merits of different makes in this respect. By the length of life of a lamp is meant, not the time it takes before actually breaking, but the time taken before falling to 20 or 25 per cent. of its original candle-power value, a meaning which is now almost universally attributed to the term "life." The length of life in this sense will, of course, depend on the efficiency at which the lamp is run, there being, of course, one most economical efficiency depending chiefly on the cost of power and lamps, and the regulation of the circuit.

As things are at present, the station engineer has no data by which he can judge whether lamps supplied to him are really doing satisfactorily or not, he only has a general impression sometimes that a new batch of lamps does not seem to be doing as well as the last, but whether this is really the case, and if so, to what extent, he is unable to say.

All lamps measured for rating should therefore be tested for vacuum and evenness of filament, the latter being a guide to premature breakdown, and in addition, the one or two lamps coming nearest to the average in the target diagram should be selected for running on life test on a circuit whose voltage is specially regulated. This test would not, of course, last more than 400 or 500 hours.

Mr. Spinney in his article does not deal with tests for length of life: such measurements would be most troublesome and expensive if made on a small scale at supply stations; but where large numbers of lamps are dealt with at a central laboratory, the whole inspection can be carried out with great accuracy and thoroughness, and should not add more than 5 per cent. to the total cost of the lamps—an expense which, even were it half as much again, would be inconsiderable, and it may without hesitation be said that the higher standard resulting from such a practice, and the increased satisfaction of customers, would amply repay the small extra expense incurred in this way.

THE WHEEL QUESTION.

The *Street Railway Journal* of July 8th contains an article by C. G. Bacon, jun., on this eternal question. From the figures in the tables below he draws the conclusions that guarantees are worthless and are never enforced generally because it is too much trouble or expense to follow out the life of every wheel; that it is not so

much the life of the sound wheels which matters as the combined average life of the sound and the failures; and that the number of failures is so great as to make the cast-iron wheel impossible for "the high-power, high-speed, and heavy-weight inter-urban, or even urban, service of the present day."

Attention is drawn to the longer life of the open-car wheels than of the closed-car wheels in every case. The amount is not very large, but it is constant, and the author, after close investigation, believes it to be due solely to the open-cars not running during the winter months when ice and snow cause destructive slipping on the closed-car wheels.

We have always held that with the heavier conditions such as these wheels were working under, even the best cast-iron wheel might have to give way to the steel-tired wheel, not because its average life made its use uneconomical when compared with the other, but because no one can afford to run serious risks owing to the chance of a wheel breaking. In England we have not reached those conditions yet, and there will be vast scope for the cast-iron wheel for years to come.

Open Cars.

Make of wheel.	Number of wheels 33 in.	Average life, miles.	Per cent. of failures.	Average life, including failures, miles.	Miles guaranteed.
"A"	202	28,434	14¾	26,789	30,000
"B"	363	39,007	16⅛	37,666	40,000
"C"	64	21,833	15¼	19,917	30,000
Closed Cars.					
"A"	317	27,018	17⅜	23,987	30,000
"B"	146	37,406	18¼	35,843	40,000
"C"	43	20,013	16½	19,105	30,000
"D"	136	29,654	16½	28,423	30,000

We draw a further inference from the tables with respect to guarantee, and that is that the makers were trading on the assumption that the guarantees would never be called into question. But the chief fact which we cull is that the several makers turn out a finished article which they all call by the same name, and profess to make out of the same material in the same way, yet this article as supplied by maker B has a life which is not far short of 100 per cent. better than the article supplied by maker C. It is reasonably certain that all the wheels tabled received exactly the same treatment both in the tramway shops and on the road, yet there is all that variation in life, and therefore in quality.

English manufacturers almost laugh outright as they quote the buyer a guarantee of 30,000 miles, irrespective of the state of the track or the previous record of the undertaking, for they know full well that the buyer will not worry about the fulfilment of that part of the contract, and if by a strange chance he does, there are the usual ways of escape always open.

When wheels are bought at so much per 1,000 wheel-miles, with no reference to the price per wheel except, perhaps, by way of a minimum, it will be the duty of the buyer to ascertain the figures which form the basis of payment with an accuracy which the seller will foster, and the net result will be that within five years there will be but one quality of wheel on the market, and that the best possible, humanly speaking.

We got the wheel-mile purchase idea from America, and we have urged it on English tramways constantly, but with poor results up to the present.

In the end the maker of *bonâ fide* cast-iron wheels will find it to his advantage himself to press buyers to contract on these terms, for he will then have a much clearer chance of annexing the majority of the market instead of finding, as at present, that buyers wobble about from one maker to another and back again, in the hope one year that A will be better than B, and in the next that B will be better than A, while all the time they never come to any real conclusion as to the relative merits of either.

The author of the article to which we are drawing attention, believes that while the life per unit of wear varies as the depth of a cast-iron tread decreases, it remains constant throughout the wearing depth of the steel tire. This sounds probable enough, as the effect of the chill must be a maximum at the new surface tapering off to zero, *i.e.*, the same hardness as the body of the wheel, at some definite depth. In this regard we should be glad to have reliable figures obtained from tests under identical and carefully observed and regulated conditions of a large number of wheels from different makers. There is room for an extensive series of tests, which would have to last for two years or more, from which illumination might be given to the comparative merits of various makes and classes of wheel, and such tests would take into consideration price, analysis, gauging of wheels and track, temporary and permanent conditions affecting rail surfaces and other matters which are all more or less vital to scientific accuracy. But, alas, although there is much room for tests there are no instruments with leisure enough to undertake them with the necessary care and attention to detail. At least we may say that the whole body of tramway engineers will agree that they could not give a fraction of the time required. So we shall go on with a note from this one and an article from that, a paper from an eminent manager favouring steel tires on unsatisfactory grounds, and a letter from a well-known engineer proving chilled iron to be the thing by the use of unverifiable statistics and a disregard of the arguments advanced by the other side. But in that way and no other do we go on in a multitude of other matters, and so some say that as we muddle through in spite of it all, tests and time and trouble are naught of practical value.

A DIRECT-CURRENT SERIES POWER TRANSMISSION SYSTEM AT 57,000 VOLTS.

We take the following details of a remarkable H.T. direct-current transmission scheme, at present under construction, from the *Bulletin de l'Institut Electrotechnique Montefiore*. The transmission is between Montiers, in Savoy, and the town of Lyons, and is over a distance of 110 miles—the greatest yet undertaken in Europe. The power to be transmitted is 6,500 H.P., and it is to be generated at 57,000 volts. This will be obtained by connecting four groups of generators in series, each group being directly driven through a flexible coupling by a turbine of 1,570 H.P. Four generators, giving 3,560 volts each, form a group.

The receiving station at Lyons will contain six groups of motors coupled to tramway generators. Each group will consist of two motors, each taking 73 amperes at 3,840 volts. Fig. 1 shows the arrangement diagrammatically.

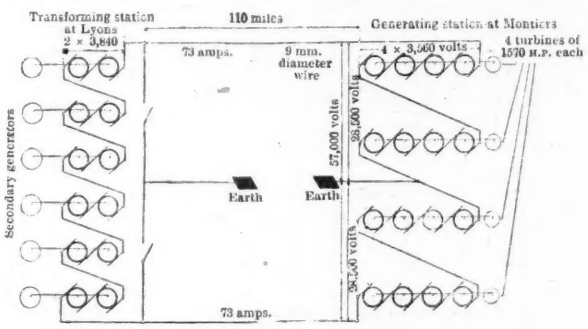


Fig. 1.

In this installation the earth is employed to limit the static voltage of the line, but it does not actually form one of the conductors, except in case of accidental damage, in which case it acts as a reserve line. In this way the cost of the line is practically the same as when the earth is used as the return, while certain useful advantages are obtained. Thus the stray currents are, normally, entirely suppressed, and, in case of breakdown, are reduced by half, whilst another important advantage is the fact that the earth is always available as a reserve line in case one of the conductors fails.

It is expected that this installation will be at work in less than a year, and we shall then hope to give further details.

STEAM ENGINE VALVES AND ECONOMY.

Considering the remarkable economies that Continental engine makers have secured with drop or stamper valves in their steam engines, it is curious that the use of this type of valve should have become practically obsolete in Great Britain.

The drop valve was once generally known as the Cornish valve, and it was made in the double form as the double beat valve. For years Continental builders have employed the drop valve for the highest class of work, and not the less since the advent of superheat, for the stamper valve is better suited for withstanding the effects of superheat than, perhaps, any other form of distribution valve.

Particular attention of the Continental variety, has not been paid to steam economy in England, because at one time coal was so very cheap, and it did not pay to the same degree to spend more upon the internal finish of a steam engine.

To-day, however, coal is very much more expensive than it was 20 or 25 years ago, so that steam economy is really of great importance, and our engine builders would do well to give more attention to it in the future than they have done in the past, or are even doing to-day. Foreign engineers make engines that will stand considerable degrees of superheat, and guarantee steam consumptions down to as little as 4 kilos per hour per I.H.P. (Cheval), which being translated into English horse-power and pounds means less than 9 lb. per I.H.P.-hour. Now the Corliss valve will not stand a temperature beyond 500° F.; at least, we seem to hear of Corliss engine builders demurring at anything higher. Continental engine makers will use superheat as high as 650° F. with drop valves.

The great point about the drop valve is that, being double-seated in equilibrio, it exercises no stress of importance on its moving mechanisms, and it has, moreover, no rubbing surfaces to wear, so that the valve is independent of lubrication. It would thus appear that the drop valve will work with steam at the maximum safe temperature to which steam can be superheated. The economy of the drop valve is not only due to tightness, which reduces the leakage losses, the small clearance, which can be secured by careful design, and to comparatively no frictional working resistance, but also to the ability to work with steam at such a temperature as will abolish most of the losses now inevitable, where superheat cannot be employed.

THE WIRING INDUSTRY.

By DONALD SMEATON MUNRO.

It is said that competition is the life of trade: the present position of the electrical industry proves that competition may contribute to its decay. This point was well illustrated by an article which appeared recently in these columns under the heading, "Is the Wiring Contractor Doomed?"

It would be easy to show that the other branches of the electrical industry had equally valid reasons for pessimism. The writer of that article, referring to makers of machinery, says, "Competition is so terribly severe in this class of business, that if the manufacturers can only keep their factories going on full time regularly they esteem themselves fortunate. Profit is, of course, highly desirable, but not always obtainable nowadays on motors."

As regards the wholesale side of the business, he says again, "Competition is keen, prices low, and profits small."

These remarks, which might easily be extended and reinforced, occur in an article which singles out the wiring contractor for probable extinction.

The common trouble is over-competition; there are more men and more money in every branch of the business than are needed to overtake available work.

It has been urged that the position of the wiring contractor is more desperate than that of others, inasmuch as these others can if need be do the contractors' work. In some branches of manufacturing the contractor will, if driven to it, do the manufacturers' work.

Every contractor would welcome an article which tended to keep or drive others out of his trade; but the contracting electrical engineer who really knows his business need not lose hope. He performs for the public a necessary service which no others can do with equal facility and perfection. Nothing is easier than to capture a few wiremen and do small jobs—and large—after a fashion. But an industry where competition is keen cannot be successfully carried on unless those who own it know the business and give it undivided attention.

True it is that a certain class of inferior and unremunerative work can be done by the incompetent, and this tends to lower prices generally.

Happily, really capable contracting engineers and well-trained wiring tradesmen are comparatively few. Hence the prevalence of the fallacy that "the qualifications necessary to a man before he can undertake a wiring job are comparatively small." People judge by those they meet most, and come to accept shoddy work as normal, with its harvest of "fires, leakages, short-circuits, constantly blowing fuses, and all the usual accompaniments of faulty wiring." Hence also ineffective and inartistic lighting, mean and tawdry installations, expensive maintenance and high electricity bills; thus gas gets its chance. But so also do the best contracting firms, whose heads are men of some scientific knowledge as well as practical engineers, and whose workmen are competent tradesmen.

Such firms are able also to secure a share of power work, and the greater part of those varied minor applications of electricity which are so constantly in demand.

Good electrical firms, however, cannot rest on their oars. They must show enterprise, ingenuity and resource. They must make the manufacturer and wholesale man feel that their competition is to be reckoned with; that they are the best agents for the wide distribution of electrical goods; and that it would not pay the wholesale trade to undertake the outlay and dissipation of energy required for doing a retail trade.

The rise of the consulting engineer for minor electrical contracts has somewhat weakened the position of the leading electrical contracting firms. The public now consider themselves less dependent upon the special knowledge of the contractor; but the results do not always justify this belief.

The architect of standing is usually strong enough to insist on his client accepting this or that contractor, notwithstanding disparity of price. But too many of the consulting men dare not do anything but accept the cheapest. They may restrict competition, but in that case they make a fetish of the lowest tender as if quoting a price were a game or lottery. They do not recognise that no two firms are quite alike in their work. This, too, will remedy itself in time.

Nothing has been said about the competition of corporations and supply companies, but much of the foregoing is applicable. If the contractors in a town are really active and efficient, it does not appear that it would be to the advantage of a supply company to extinguish these, their most effective agents in promoting the use of electricity.

Then in country districts also, isolated plants are frequent, and there the competition of supply companies is seldom effective.

One thing, however, is evident, that only by combination can the contracting trade fight the many adverse influences which surround it. The Electrical Contractors' Association may not be a perfect organisation for its purpose, but it is meantime the only one available, and every far-seeing contractor ought to become a member, and then better it if he can.

CORRESPONDENCE.

Letters received after first post on Wednesday morning cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

Consulting Engineers and their Specifications.

Will you permit me to ask the question whether the time has not arrived for a resolute stand to be made against the too-clever-by-half actions of some so-called consulting engineers. May I explain?

Recently the Guardians of a London Union asked for tenders for the equipment of their new Union premises; the specification was not too simple, and the usual care and attention was devoted to its meaning. I sent in a tender which was accepted by the engineers on behalf of the Guardians, pending the L.G.B.'s consent to the expenditure. Samples—which have neither been returned nor paid for—were called for. Visits to London were indulged in to meet the engineers. Labour was arranged for and staff provided.

Surveys were made, so that the work could be commenced at 24 hours' notice, but the L.G.B. objected to the very elaborate provision made for the lighting of a workhouse, and the Guardians were called upon to cut down expenses. This necessitated other tenders being called for, and I again went through the mill, with the result that my tender was not accepted.

My complaint against the engineers is, that they specified that certain goods, valued at about £1,000, should be bought from a certain firm whose name was specified. Now, these particular goods are not made by the firm in question, nor were they the agents of any firm of repute, but simply middlemen, and their price for a very inferior article was fully 40 per cent. more than the quotation from the best manufacturer.

This particular firm, whose name appeared in the specification, called upon me for the order, and they got my reply, which was very clear and definite, that I should not spend a penny beyond manufacturers' price, and I wanted a much better article than the sample they had sent me. Oh, they replied, but our name is specified. I admitted this, but added that no consulting engineer living would compel me to buy a second-rate thing from a middleman at 40 per cent. over the cost of the best.

This conversation was probably reported to the consulting engineers, and may or may not have been the cause of my failure to secure the order.

My out-of-pocket expenses on this wretched business amounted to £50. I admit that it was probably my own fault; the goods should have been bought as specified and no objection raised; nevertheless, in common fairness, the £50 should be repaid by someone.

Why should these men be permitted to specify that the contractor *must* go to a certain butcher's shop to buy a pound of tea, and then get something dear and nasty?

Another case of very recent occurrence, this time an asylum in Wales; the primary qualification for firms ten-

dering was, that satisfactory reference should be given to similar work carried out. I don't object to this, but as I believe the contract is signed, is it impertinent to ask if the reference was satisfactory, and where the previous work had been carried out?

This consulting engineer very kindly specified the exact size of each feeder, sub-feeder and main, but he did not give a single length. This last-named information would have made it unnecessary to make a special journey across England.

I mildly asked the favour of being supplied with the lengths, but the reply was given by one who has evidently studied his own dignity, and I was told that "the consulting engineer will not consider the tender of any firm who has not sent a representative to study the plans."

This meant three days thrown away, but it had to be done. I went to Bristol where the plans were, and on arrival was slightly surprised, but not slightly disgusted, to find that the plans had been sent by post, or otherwise, to another firm 20 or 30 miles away, and I could not see them until the competing firm had finished their examination.

I presume the firm in question to whom such a favour was granted, whilst it was refused to me, had friends at headquarters, and again I ask, How long will this intolerable backhanded dealing be permitted?

Tendering to public specifications entails a great amount of labour and cost to the firms who undertake it, and I protest strongly against being mulcted in other and unnecessary costs, simply to meet the fads of those who get paid for the time and trouble expended.

Personally, I have decided that in all future specifications where the slightest trace of jobbery can be traced, I will not only refuse to tender, but will do my best to throw light on the matter and bring it before those who are being victimised.

T. Scott Anderson.

Sheffield, *August 30th*, 1905.

Evaporative Trials of Bennis Plant.

We have seen in your issue of August 25th, page 312, a "Note" entitled "Evaporative Trials of Bennis Plant," which professes to be a *reductio ad absurdum* of a test published in a recent pamphlet of ours. The "Note" is interesting, because it contains an illustration of a new method of calculating the absolute pressure of steam from the gauge pressure—namely, by *deducting* 14·7 lb. per sq. in. from the latter figure instead of adding that quantity. While this innovation may be quibbled at, or even sneered at by the censorious, there it is.

In order that we may make our reply to your "Note" intelligible to your readers, we enclose a copy of the test in question.

It is stated in your "Note" that "The following are the essential figures with the Bennis stoker:—Steam pressure, 81·2 lb., *therefore* boiler temperature 299·34." This inference as to temperature is not ours, and it is wrong. A gauge pressure of 81·2 lb. per sq. in. corresponds to an absolute pressure of 95·9 lb. per sq. in., and not to 66·5 as is calculated in your "Note" by means of the new formula referred to above; the true saturation temperature is 324·7° F., according to D. K. Clark.

It is, then, assumed that 20 lb. of waste gases left the boiler per lb. of coal burnt. We have not been able to trace the reason for this assumption. In criticism of what claims to be the result of careful observation, we want facts, not assumptions. We will, therefore, give a few facts. The coal used at this test was not analysed, but, from analyses in our possession of the same class of coal from that district, we are able to state that it contains approximately:—

Carbon	...	66 per cent.
Hydrogen	...	6 ,,
Oxygen	...	8 ,,
Ash ...	...	20 ,,

To burn 1 lb. of this coal, the weight of oxygen required theoretically is—

$$(\cdot66 \times \tfrac{8}{3} + \cdot06 \times 8 - \cdot08)\text{ lb., or } 2\cdot16\text{ lb.}$$

To supply this oxygen, the weight of air required is—

$$(2\cdot16 \div \cdot23)\text{ lb.} = 9\cdot39\text{ lb.}$$

Report of Competitive Tests Between Hand and Machine Firing at Messrs. Firth & Sons, Brighouse.

—	Hand.	Machine.
Date of trial	March 15th, 1905	March 16th, 1905
Duration of trial	Four hours	Four hours
Class of boilers	Lancashire (Horsfield) 8 ft. by 30 ft.	Lancashire (Horsfield) 8 ft. by 30 ft.
Number of boilers	one	one
Boiler heating surface ...	1,055 sq. ft.	1,055 sq. ft.
Grate surface	42 sq. ft.	36 sq. ft.
Average steam pressure ...	73 lb. per sq. in.	81·2 lb. per sq. in.
Average temperature of feed water	245° F.	229° F.
Total water evaporated ...	46,300 lb.	55,600 lb.
Water evaporated per hour ...	11,575 lb.	13,900 lb.
Water evaporated per hour as from and at 212° F. ...	11,575 lb.	14,295 lb.
Water evaporated per hour per sq. ft. of boiler heating surface	11 lb.	13·5 lb.
Class of fuel	Holroyd engine coal	Haigh Moor pea slack and smudge mixed
Price of fuel per ton	10s. 4½d.	7s.
Calorific value of coal per lb.	13,700 B.TH.U.	12,600 B.TH.U.
Total coal consumed	6,384 lb.	4,984 lb.
Fuel consumed per hour ...	1,596 lb.	1,246 lb.
Fuel consumed per hour per sq. ft. of grate area ...	36 lb.	34·6 lb.
Lbs. of water evaporated per lb. of fuel	7·25	11·2
Lbs. of water evaporated per lb. of fuel as from and at 212° F.	7·25	11·5
Thermal efficiency of boiler	51·1 per cent.	88·1 per cent.
Cost of fuel to evaporate 1,000 gallons of water as from and at 212° F.	76·7d.	32·6d.
Extra evaporation per hour by Bennis stoker and furnace	.....	12 per cent.
Extra evaporation per lb. of coal by Bennis stoker and furnace, allowing for difference in calorific value ...	.....	17·2 per cent.
Saving per 1,000 gallons machine over hand-firing ...	.....	44·1d. or 57·5 per cent.
Smoke	Continuous black	None

Remarks.—All fuel was carefully weighed and water measured by Siemens meter. Black smoke continuous during hand-firing. No black smoke during stoker test.

We are not used to burning coal with over 100 per cent. excess of air, like some other stokers. We find 30 per cent. ample. Therefore, the total weight of air supplied per pound of coal is $(9\cdot39 \times 1\cdot3)$ lb. $= 12\cdot21$ lb.

To this must be added ·8 lb. for the combustible portion of 1 lb. of coal, and the total weight of waste gases is 13·01 lb.

Assuming (we have here no choice, as the temperatures were not taken) an initial temperature of 50° F., and a final temperature of 400° F., we have a range of temperature of 350° F., and the heat carried away by the waste gases, having an average specific heat of ·25, can be calculated as follows:—

$$13\cdot01 \times \cdot25 \times 350 = 1{,}138\text{ B.TH.U. (to the nearest integer).}$$

The argument in your note is excellent in one respect. It provides a useful object lesson in the use of figures, incorrect formulæ, and "assumptions" in the zealous service of your advertisers.

What pleases us best, however, is the fact that no hint is given as to the author of the note, because, in our opinion, these comments are a poor advertisement for him, or some other member of the editorial staff.

Our study of this one "Note" has been so discouraging to us, that we have not had the heart to study others in the same issue. Surely there are plenty of Technical College students ("experts" need not occupy their time with such matters) to whom editors might apply for assistance in deleting the ridiculous.

Ed. Bennis & Co., Ltd.
Alfred W. Bennis.

Little Hulton, Bolton,
August 30th, 1905.

[The error referred to in paragraph 1 of the foregoing letter is freely admitted. The boiler was therefore about 25° hotter than we had made it appear by our mistake in subtracting, in place of adding, the atmospheric difference of 14·7 lb. However, let us at least have the credit of having given Mr. Bennis the benefit of 25°, for the error was in his favour. Now as to the coal. With 0·66 of carbon and 0·05 of available hydrogen, the calorific capacity per pound of coal will be at most about $(14{,}500 \times 0{\cdot}66) + (52{,}000 \times 0{\cdot}5) = 12{,}170$ B.TH.U., as compared with the 12,600 B.TH.U. stated by Messrs. Bennis. From this we will subtract the impossible figure of 1,138 B.TH.U. which Mr. Bennis claims to be carried away in the waste gases, and to obtain which he has assumed only a 30 per cent. excess of air that everyone should know was not obtained. Then $12{,}170 - 1{,}138 = 11{,}032$ B.TH.U. for radiation and evaporation.

Mr. Bennis claims 11·5 lb. for evaporation, or the equivalent of, say, 10,819 B.TH.U., which, with his impossible figures, means 98 per cent. of actual boiler absorptive heat efficiency and 2 per cent. radiation losses, to say nothing of the combustible which remains in the ash.

These impossible figures Mr. Bennis asks us to believe and presumably to endorse in the interests of our advertisers. We fail to see how the interests of our advertisers can be secured by publishing impossible "results." Too much harm has already been done to English manufacturers by the readiness with which impossible and ridiculous claims for American and other products have been swallowed by people who should know better, and we, at least, must decline to endorse such figures. We note that in reply to our assumption as to the weight of gas, no proof is afforded that it is not nearer the truth than Mr. Bennis's 30 per cent. excess. Mr. Bennis is quite unjustified in assuming a final temperature of gases of only 75° F. above the boiler temperature, especially as he claims to be evaporating 13·5 lb. of water per sq. ft. of heating surface per hour.

Mr. Bennis fails to establish the slightest probability of truth in his claim for a thermal efficiency over all of 88·1 per cent. Had he claimed 78 per cent. he might have felt proud of possessing a stoker that would do so much. But 88·1 per cent. makes engineers to scoff. Mr. Bennis cannot get one of the Boiler Insurance Co.'s to show such a result on an independent test. He cannot get an honest independent engineer to put his name to such a figure. If 88 per cent. be correct, what produced the efficiencies of 57·3 and 68·4 on page 10 of the same pamphlet under easier conditions? Why did the already exploded efficiency of 84·9 per cent. at Sheffield on page 7 not attain even a higher impossible? Why did Messrs. Inskipp and Mackenzie only secure 7·83 lb. evaporation on page 12?

The writer of the note will be very glad to meet Mr. A. W. Bennis and endeavour to learn from him how an efficiency of 88·1 per cent. is possible. When impossible tests are published there is a singular unanimity of condemnation of anonymous criticism. Mr. Bennis ought to have first published the authority for his 88·1 per cent. test before girding at a similar anonymity of criticism, though there can be no question of persons when dealing with facts. Let Mr. Bennis show that Regnault and Rankine and Joule are wrong, for, after all, these men are Mr. Bennis's critics, not our comparatively insignificant note writer, who is so far merely an acceptor of their teachings. If they are wrong—well! even then all the mistakes in the world will not render true the thermal efficiency claimed by Mr. Bennis for his own or any other make of stoker or for hand firing.

Finally, will Mr. Bennis state what in his belief is the average loss of heat by radiation from boilers and brickwork? Though he disputes our figures, and corrects one to his own disadvantage, he has not put forward a single figure to support his claim of 88·16 per cent., and what is more, we do not think so badly of his intelligence as to believe he will make the attempt.—Eds. E.R.]

A Milking Problem.

In reading over Mr. Ralph W. Birkett's article, I was much interested in his arrangement for "milking up" low cells from the Highfield booster. He says that the whole battery of 197 cells was connected across the motor, while three or more pairs of cells in different parts of the battery were connected in parallel across the booster armature.

Will Mr. Birkett please explain how it is possible to connect cells in parallel from different parts of a battery without causing a dead short on the intermediate cells, the whole battery being connected in series?

A diagram of this arrangement would be interesting.

C. P.

Inspection and Testing of Tramway Overhead Equipment.

In the interesting article by Mr. R. N. Tweedy in your issue of August 11th, a description was given of an apparatus for testing, by separately flashing each insulator of an overhead equipment from the platform of a tower wagon. No doubt such an arrangement gives, in a simple way, the desired result; but the fact of having to stop at each insulator makes it a slow method, and, therefore, with Mr. Tweedy's apparatus it is obviously not convenient to carry out the tests over an extensive system more than once a week, as suggested in the article. For this reason the writer some time ago devised a spring-contact arrangement for attachment to the trolley boom, by means of which the insulation resistance of each insulator can be arrived at approximately, by a reading on a suitably constructed voltmeter, whilst the car is in motion. The apparatus is sent out on a car *every day* before the service commences. Any insulator showing bad insulation is further inspected and, if necessary, replaced by the tower wagon gang. The instructions are, that the primary insulators—*i.e.*, hangers—are to be tested one day, and the secondary insulators (Brooklyns, globes, wheel insulators, &c.) the next. The results, so far, have proved most satisfactory, although where poles, &c., are not earthed, the results on the secondary insulators are apt to be misleading. The testing has not hitherto been carried out on all sections of the system, because the usual initial difficulties were encountered in making the device applicable both for centre and side-running trolleys, &c. These difficulties have now been overcome, and the writer hopes soon to receive from the makers the apparatus in its final form, after which it will be used on each section of the system daily. As this apparatus only provides for testing the insulators, a further detailed inspection of the other portions of the equipment is carried out weekly.

A. H. Pott.

London, *September 2nd*, 1905.

Mr. Tweedy seems to have got the idea that I am not aware that fuses and lamps in series are not needed; I may say that a reply from Mr. Tweedy was fully expected, but, on the other hand had I left the fuses out of my test and used lamps only, most of the readers of this paper would have asked: What protection have the lamps from the high voltage of the trolley wire? Mr. Tweedy says that this test is not so convenient as his; I will not say nay, but will give two advantages it has over Mr. Tweedy's, for, in the first place, it does away with the services of the driver, as that man, if of the right sort, would have full control of the horses and brake and be able to put the wagon in any position without waste of time. Also, in the second place, there is no flashing of the wire, as Mr. Tweedy suggests in his test, the same not being allowed on every system; should it be allowed I would fully appreciate Mr. Tweedy's test. Trusting that he will give some more suggestions on the maintenance of overhead work for the benefit of those employed on the same.

S. Worthington.

Manchester, *September 3rd*, 1905.

Earth Detecting Instrument.

Having been away, I did not see "Mining Engineer's" interesting letter in the Electrical Review of August 25th in time to reply in your last issue.

There are two explanations of the fact that although a deflection is obtained on each main, there is none when on the "normal" stop:—(1) That the insulations of all three mains are equal; or (2) That the three capacities are equal.

E

The "normal" stop connections of the E.E.C. leakage indicator which "Mining Engineer" has in use, are shown in fig. 1. It will be seen that the meter is connected between an artificial "neutral point" and the earth, so that if the capacities and insulations of all the mains are equal no deflection will be obtained. On switching, however, on

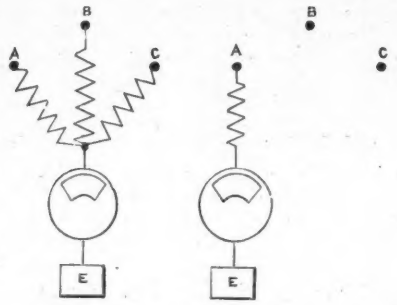


Fig. 1. Fig. 2.

to the A stop, for example, the connections will be as shown in fig. 2, in which case the current flowing through the instrument to earth returns to the mains B and C in parallel, due allowance being, of course, made for phase differences.

This current will in all probability be partly a capacity current and partly a leakage current, and it is impossible, off-hand, to say how much of the 33 and 21 milliamperes respectively is due to capacity; this is not, however, a matter of great moment, as the capacity current will remain practically constant, so that any change in the deflection from day to day can be safely ascribed to leakage.

The result of an earth on either phase, on the "normal" reading, is clearly shown in "Mining Engineer's" three last experiments. Earthing one of the three phases at once increases the "normal" reading from 21 milliamperes to 50 milliamperes, which is the full deflection of which the meter is capable, and the faulty cable can be at once located by noting that the deflection on the indicator, when connected to it, is zero, while with the switch on either of the other two stops it is 50 milliamperes. (It should be remarked that either the instrument described by "Mining Engineer" is cross-connected, or else a slip has been made in transcribing the results, as the zero deflection should, of course, in each case be obtained when the instrument is connected to the earthed main.)

It would be extremely interesting if "Mining Engineer" would measure the insulation of the two circuits independently—say, by means of a direct-current insulation set—as one would then be able to form an idea of the magnitude of the capacity current in this particular case.

Kenelm Edgcumbe.

Westminster, *September 4th*, 1905.

Some Arithmetical Questions for Mr. Byng.

With apologies, and promises that this shall be my last word, allow me to reply to Mr. Pollard Digby's letter. As the question concerns the unemployed, any contribution must be of interest; it is the most important problem at the present moment.

Mr. Digby's letter brings us to a new phase. The point practically comes to this: Whose advice is the nation to take upon the coil of unemployment—that of the manufacturers who employ labour, or that of the statisticians and others who do not employ labour?

Mr. Digby's opinion is that every loyal citizen should repudiate my dicta. And why? Because what I say "savours of feudalism, serfdom and the planters who wallop their own niggers," and because I am "a manufacturer seeking higher dividends." Truly your correspondent can have but little notion of the tribulations of a manufacturer working under Free Trade conditions. Nevertheless, I am obliged to him for the epithets bestowed upon me in most polished language. The curious part is that Mr. Digby does not stand alone in answering arguments in this fashion. It is the invariable practice of those who hold opinions *à la* Pollard Digby, and I am getting accustomed to being called monopolist, tyrant, trust magnate, and to be told that my knowledge is prejudiced knowledge by those who have no knowledge at all.

Were this state of affairs purely personal I would grin and bear it; but the history of the last two years shows that hundreds of manufacturers are being treated as I am, and that the majority is with Mr. Digby. He is welcome to take comfort from my admission. But what is the result of this, to my mind, topsy-turvy management of our public affairs?

The House of Commons has given us an Unemployed Bill; our municipalities are spending public rates to alleviate the distress; we have Mansion House and newspaper collections—all a combination of Socialism with charity. Have my opponents any further remedy to propose? None whatever, except more Socialism, and more charity and more rates. Has all this reduced the evil? It has not. Unemployment is as bad as ever, and, I am sure, it will increase, if such policy be continued, until it will become an overwhelming disaster.

We manufacturers, on the other hand, promise to conquer the evil by giving more employment on condition of obtaining the same protection which is enjoyed by the foreign manufacturers from whom we now buy goods which we could make ourselves.

Our plea is not heeded; we are told that we are selfish, prejudiced, and have some sinister ulterior motives. The majority prefer to listen to empty phrases that fill no stomachs, such as Mr. Digby's, who says, "Free Trade is the solution making for the maximum of justice."

All right, but does it bring employment? And some day even the *genus* Pollard Digby will find out that the most important man in the realm is the man who "may wallop his niggers," but who pays their weekly wage, and will take his advice—when too late.

G. Byng.

Cranham, *September 5th*, 1905.

Statistics.

Recent correspondence in your columns relating to consular reports, commercial engineering, and Mr. Byng's statement to the G.E.C., all seems to bear out the contention made, I think, by "B. B." under the first heading, that trade statistics and reports for this country stand in need of final selection and compilation by technical experts before they can be of much use to commerce in general. The statistic, as at present received, generally *en masse*, is a kind of mental pabulum needing a long and severe process of digestion to get the good out of it. Hence, when offered in proof of a statement, the potential recipient is apt to sniff at the result of industrious application to a whirlpool of figures, and inquire as to its date and pedigree; and if utilised in bulk, the amount of nourishment obtained is insignificant compared to that of the matter absorbed (an educational process) and the time spent in rumination is not at the command of everyone. Then, naturally, the benefit obtained from these processes varies according to the state of health of the recipient. The fact that A has sold 1,000 more examples of the product *a'* than B has, does not always appeal to B as a sign of national prosperity. A digest of these various reports and figures with deductions of the logic, of which there could be no question, would be of the highest value.

A perusal of the list of members of the I.E.E. will reveal the names of at least half a dozen members who also belong to the Royal Statistical Society, eminently qualified to deal with the subject.

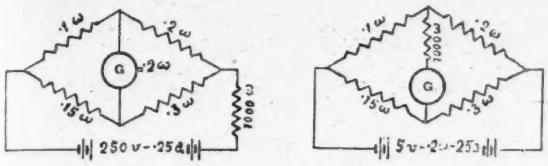
C. V. Biggs.

London, S.W.

Mains Testing.

Mr. David Smith has misunderstood me, I think. Certainly the use of a large current in a loop test *does* increase the sensitivity. I merely pointed out that it was possible to localise a fault with a very small current. With my bridge, a fault may be localised within $\frac{1}{2000}$th part of the loop, *i.e.*,

within as small a space as you can read accurately, using only half an ampere. Any increase of the testing current beyond this would not increase accuracy, unless you had a perfect scale and a vernier; and without this refinement the fault is found on any ordinary run of cable within the limits of a working hole, say a yard or so, for few unbroken cables run



a length of 2,000 yds. But when the fault is of high resistance you have the choice of two alternatives; either have it in your battery circuit and so use a small current, or have it in series with your galvanometer and neutralise the advantages of your large current. Which arrangement in the two sketches herewith would be the more sensitive?

Finally, I object greatly to having the fault in the galvanometer circuit, however low its resistance, because, in addition to resistance, it often contains an E.M.F. which, theoretically, may be balanced and so neutralised, but can only be so if it remain constant, which it seldom does; and a varying E.M.F. of a millivolt or less in series with your galvanometer would absolutely ruin the test.

G. C. Knight.

Walthamstow, *September 5th*, 1905.

THE ELECTRICAL EXHIBITION AT OLYMPIA.

Arrangements are well in hand for the electrical exhibition which is to be opened by the Lord Mayor of London at Olympia on the 25th of this month. The erection of stands is commencing this week, and we would make a timely suggestion that exhibitors should see that their stands and exhibits are absolutely completed by the day of opening. It is always aggravating to the visitors to a public exhibition to find that in the early days things are only half in readiness, and if this view becomes generally circulated, the exhibitor necessarily suffers. We know that it sometimes happens that exhibitors themselves are not always their own masters so far as the completion of stand erection is concerned, but if they use all the influence that they have, and if the management where possible brings its pressure to bear upon those carrying out the work, it ought to be possible for carpentering, stand fitting and furnishing work to be unnecessary on or after the 25th. There is still more than a fortnight remaining, and we hope that these few words will not pass unconsidered by the 140 odd exhibitors who have booked space.

REVIEWS.

Sir Henry Bessemer, F.R.S.: An Autobiography. London: *Engineering*, 1905. Price 16s. net.

It is needless to say that this handsome quarto volume must prove of extraordinary interest to everyone who reads it, for even among our notable pioneers of industry the late Sir Henry Bessemer stood in that front rank, the members of which may almost be told upon the fingers. Countless men have arisen amongst us of surpassing brilliancy in commerce or in their own department of research; many individuals have become so versatile as to be thought distinguished experts by the commercial world, and clever men of business by their compeers; but comparatively few appear actually to have combined the commercial spirit with the scientific instinct in the fashion exhibited by Sir Henry Bessemer. Nevertheless, the author and subject of the present sketch belonged to a smaller class still, for it is hardly too much to say that the name of Bessemer would have been widely known if his chief invention had never been made. During the whole of his active life Bessemer was so unfettered by tradition, and possessed such a wonderful power of grasping instantly the essential point of each problem presented to him, that he scarcely touched any branch of industry without improving or revolutionising it. And yet, so varied were Sir Henry's studies and so deeply have all his inventions been cast into shadow by the steel converter, that even the reader who imagines himself to have a fair general knowledge of Bessemer's life-work, cannot help a feeling of surprise as he peruses the earlier pages of the present volume.

The autobiography proper ends with the financial failure of the Bessemer Saloon Steamboat Co., and the book is, therefore, brought to its inevitable conclusion in a chapter written or inspired by Mr. Henry Bessemer. In that chapter there is a list of British patents granted to Sir Henry—117 in number—dated between March, 1838, and January, 1883. Even these afford no measure of Bessemer's activity, as some of his work was done in secrecy, some for amusement only, and some was commercial rather than technical. A mere enumeration of the apparatus devised or improved by him would occupy much space; but omitting all such comparatively trivial matters as his partial foreshadowment of the linotype machine and the corridor train, processes for, or improvements in, the manufacture of figured velvet, plumbago, optical glass, sugar, boiled oil and saloons for steamships, two matters seem to stand out as possessing almost as much interest (not importance, of course) as is attached to the story of the converter itself. One of these was the invention of a revenue stamp which could not be forged or illegally used a second time; the other, Bessemer's process for making "bronze" powder.

As a young man Bessemer devised an ingenious but complicated method of making perforated revenue stamps for application to parchments and the like, which, to some extent, anticipated the punching arrangement of to-day. This was on the point of acceptance by the authorities, when the practical value of the plan was suddenly destroyed by an inspiration that occurred to the lady who shortly afterwards became Mrs. Bessemer. Her idea was that each stamp should bear, as part of its embossed design, the date of its application to the deed. The improvement was communicated to the stamp office authorities, was adopted, was said to save the country some £100,000 a year, and has remained in use up to the present day. Bessemer's sole recompense was a knighthood conferred after some protest and 40 years' delay, an economical form of reward which had at least the merit of shedding half its lustre on the true inventor.

The second striking event was Bessemer's discovery of a mechanical process for making metallic "bronze" powders, which enabled him to undersell the whole trade enormously, and yet to make a large profit. The interest of this episode lies in the fact that he did not present his ideas to a government department, nor even claim the 14-year protection of the patent law, but by keeping his own counsel, succeeded in preserving his secret for some 40 years. It was a nice little business, requiring so little labour that his brothers-in-law attended to the machinery, even the stoker and engine-driver having no access to the plant. The machines were made by several manufacturers in small and unintelligible pieces from working drawings dissected from the complete plans, and they were assembled and erected by the inventor himself. The importance of the episode lies in the fact that the profits of the business were mainly responsible for giving Bessemer the time and money absorbed by his researches which finally culminated in the converter.

The discovery of the Bessemer process for making steel may, to some extent, be said to have been forced upon Sir Henry. Largely by the encouragement of Napoleon III. (whose Grand Cross of the Legion of Honour he was not allowed to accept), Bessemer was led to design rotating projectiles, for which the ordnance of the day was hardly strong enough, and so he was induced to study methods of preparing some kind of iron, softer and tougher than cast-iron, yet cheaper than the cast cement steel of the period. The story

of how he was led to a premature success through the employment of non-phosphoritic pig, of the paper he read at Cheltenham before the British Association in 1857, of how he and his partner granted licences which the phosphorus of most ores or fluxes rendered valueless, and of how he eventually achieved success in his works at Sheffield, must be known in its broader lines to all readers; but the details and anecdotes given by Sir Henry Bessemer in his autobiography, shed fresh light in places, and are throughout of absorbing interest. Some of the stories are unpleasant, but are the better for telling, and seem to be told without undue animus; for instance, the way in which Bessemer steel was treated by the War Office people, and the manner in which it was ignored by the Admiralty. One can hardly help feeling that it must be ignorance of history or wonderful patriotism which causes any British subject to approach a British Government department with a new invention. More personal matters of a disagreeable kind are touched with as light a hand as can be expected when one party to the dispute wields the pen.

The final chapter includes many little details omitted from the autobiography, and contains an account of the relaxations of Sir Henry's latter years. The unfinished reflecting telescope and mounting he designed, the diamond polishing plant he constructed, his unsuccessful solar furnace, and the towns named after him are all mentioned. His non-rolling saloon, which failed for lack of funds and because the ship bearing it did not answer her helm, is claimed by Sir Henry never to have been completely finished, nor tested at sea, and therefore never to have failed of itself—a statement in which there appears to be much truth.

The volume is nicely bound and so creditably printed that we have noticed only two misprints in it. It is dedicated to the President and members of the Iron and Steel Institute with which Sir Henry Bessemer was on friendly terms for 25 years. People often say that biographies such as this are splendid tonics for the youthful aspirant of fame. Perhaps they are; certainly it is good to hear one of the most successful of modern inventors declare that "few men have made more mistakes than I."

BUSINESS NOTES.

Advertising American Manufactures.—The United States Department of Commerce and Labour reports that arrangements have been completed for the Export Shipping Co., of New York, to send a vessel on a 6,000-mile voyage for the purpose of exhibiting American manufactured products in various ports of the world. We have a dim recollection of an attempt at something of this sort being tried by British manufacturers some years ago.

Italian Trade. — In looking through the pages of Italian technical journals, the absence of the names of English firms is very noticeable. German, Swiss, Belgian and French firms have representatives amongst the commercial engineers carrying on business in the various Italian towns, and their names are in consequence kept prominently before the readers of the technical papers. English manufacturers should look into this matter, and endeavour to find a market for some of the specialities in which they excel.

Consular Notes.—Brazil.—The Austro-Hungarian Consul at Rio de Janeiro in a recent report, states that harbour and street construction in Brazil have attracted the attention of German, English, and American capitalists who are seeking to establish transport and lighting plants. In October, 1904, the "Compagnie Nationale d'Electricite," with a capital of 2,500,000 fr., opened their works at the waterfall of the Ribeirao de Lages in the municipality of Pirahy, near Rio de Janeiro. In the same month an American company, "Rio de Janeiro Light and Power Co." was constituted with a capital of $50,000,000, of which $25,000,000 was paid up. The syndicate has a concession for the appropriation of the water from the fall in Sapucaio, 75 kilometres from Rio de Janeiro, and will use for commercial purposes 50,000 H.P. of the 100,000 H.P. estimated as being available. The "Compagnie de Tramways de Villa Isabel à Rio de Janeiro" has undertaken the work of converting the horse tramways into electric tramways, and although by contract the works were to be finished by April 19th, 1907, it is estimated that the system will be ready by the end of 1905. Of the 50 cars necessary, part are being obtained in Europe, and part are being manufactured in the company's works in Rio de Janeiro. The capital and directorate are German.

California.—Electrical undertakings in California are undoubtedly remarkable, and the distances of transmission of current very great. The Belgian Consul at San Francisco, commenting on this question in his report recently published, states that the Standard Electrical Co. have secured a concession for the appropriation of the waters of seven lakes, with a superficial area of about 400 square miles, and situated about 125 miles from San Francisco. Two canals have been constructed which convey the water about 18 miles to the pass, where the electrical generators have been installed. This company supplies electricity for lighting and motor purposes to San Francisco, Stockton, San José, and about 30 other towns situated within a radius of about 200 miles.

Eastern Telegraph Co.—This company has opened a telegraph station at Exchange Buildings, Quay Side, Newcastle-on-Tyne.

New Electric Delivery Van.—A somewhat novel form of electric motor delivery van has recently been brought out by the Titan Maskinfabrik, of Copenhagen. It is a three-wheel vehicle intended for loads up to about 5 cwt. A 1½-H.P. electric motor of the double-pole type drives the single rear-wheel through chain gearing. The electrical energy is furnished by a battery of 40 cells of Cologne Accumulator Works type, arranged in two groups in the bottom of the van body. The controller is adapted to give two forward speeds, two braking positions, and a reverse motion. The driver is mounted over the rear wheel, and controls the steering by a lever at his right. A pedal operates a band brake working on a disk attached to the rear wheel; when the brake is applied, the current is cut off.

German Electrical Machinery Imports and Exports.—Returns just to hand show that during the six months ending with June last the imports of foreign electrical machinery into Germany amounted to 704 tons, as compared with only 592 tons in the corresponding period of last year. There has also been an increase in the exportation of German electrical machinery from 6,528 tons in the first half-year of 1904 to 6,633 tons in the six months ending with June last.

Australia.—The Australian Customs authorities have lately given a decision to the effect that "accumulators, when an integral part of a motor engine for cycles" are to be classified as "machinery and appliances n.e.i. electrical," the duty being 12½ per cent. *ad valorem*.

Italy.—La Societa Forni Elettrici Stassano is the name of a company which has just been formed in Turin to develop a new electrical ore-smelting furnace.

For Sale.—The Underground Electric Railways Co. of London, Ltd., is offering a storage battery, Highfield booster and switchboard for sale. See our advertisement pages for particulars.

The Commissioners of His Majesty's Works invite tenders for the purchase of the electricity generating plant at the Tower of London. Particulars by appointment with Mr. Ready, Electrical Department, Royal Courts of Justice, Strand, W.C.

Low v. High Voltage Lamps.—The British Thomson-Houston Co. announce that in future they will make no distinction in price as between their high-voltage and low-voltage incandescent lamps. Heretofore a distinction has been generally made against the high-voltage lamp in this respect, and this has not infrequently led to complaints from consumers when the supply has been changed over from low voltage to high voltage. It is believed that the B.T.H. new policy will commend itself to station managers and consumers.

Llandrindod Wells Electric Light Co.—On August 30th in the Vacation Court, on an application made by the Llandrindod Wells Electric Light and Power Co., Ltd., Mr. Justice Lawrence extended the time during which the registration of certain debentures might take place. It was said, in support of the application, that the registration had not taken place owing to inadvertence.

Johannesburg Tramways Plant.—We read in the *British and South African Export Gazette* that owing to the wreck of the *Clan Munroe*, fresh orders will have to be given out for the machinery for the power house of the Johannesburg electric tramways.

Direct Spanish Telegraph Co.—This company has now opened an office in Newcastle at K Exchange Buildings (Quayside), which is in direct communication with its cable system between England and Spain, *via* Bilbao.

Fire-Resisting Materials for Electric Railways.—Addressing the meeting of the Fire-Resisting Corporation in London on 1st inst., Mr. E. Marshall Fox, the chairman, said that there was a demand for treated wood for electric railway carriages. Some two years ago the world was startled by that dreadful calamity on the underground railway of Paris, when 100 persons were burned to death because of the woodwork catching fire, thus giving a terrible illustration of the danger from fire. Notwithstanding this awful illustration, it was deplorable to think that only a very few of the underground systems in London had taken the precaution to safeguard the lives of the travelling public from this danger. Mr. Yerkes, who had just completed the electrification of the Underground Railway, was the first to take advantage of this scientific method of ensuring protection from fire of the woodwork of the cars. He caused to be treated by this company the whole of the new carriages of the Underground Railway, some 420 in number, involving the treatment of over 250,000 cubic feet of wood. These cars were now running on the District Railway. Although they had done everything possible to induce the other railways to adopt like precautions, they had as yet, except in one or two instances, not succeeded; but they hoped before long the autho-

rities whose duty it was to see that the travelling public were safeguarded from this danger would insist that all the railway companies should see to it that their wood was impregnated chemically.

Fire.—The fire that took place at 5, Comford Court, Market Street, Manchester, in the early hours of Thursday morning, August 31st, though it burnt out the centre of the building, did not affect Mr. S. Burton Edwards much. His premises, which are on the ground floor, sustained slight damage by water, but his stock of Gilbert arc lamps and Sturtevant starters, &c., has not been touched, and business is going on as usual.

Committee on Commercial Intelligence.—The *Times* publishes the following interesting announcement from the Board of Trade:—

"The period of five years for which the Advisory Committee on Commercial Intelligence was appointed in 1900 having terminated on May 24th last, the President of the Board of Trade has now appointed a new Committee, consisting of the following gentlemen, for a further period of three years, to continue the work undertaken by the late Committee:—Sir F. Forbes Adam, C.I.E., the Lord Avebury, Sir Alfred Bateman, K.C.M.G., Sir Hugh Bell, Bart., Mr. H. Birchenough, C.M.G., Mr. T. F. Blackwell, Mr. F. Brittain, Mr. T. Craig-Brown, Mr. A. Wilson-Fox., C.B., Board of Trade, Mr. C. A. Harris, C.B., C.M.G., Colonial Office, Mr. T. W. Holderness, C.S.I., India Office, Sir W. H. Holland, M.P., Sir Francis Hopwood, K.C.B., C.M.G., Board of Trade, Mr. A. Bonar Law, M.P., Board of Trade, Mr. Algernon Law, Foreign Office, Mr. W. H. Mitchell, Sir R. Lloyd Patterson, Sir Albert Rollit, M.P., Mr. H. Llewllyn Smith, C.B., Board of Trade, the Lord Strathcona and Mount Royal, G.C.M.G., Mr. D. A. Thomas, M.P. Three other members whose names are not yet decided on are to be appointed on the nomination of the Secretary of State for the Colonies to represent South Africa, Australia and New Zealand.

"The terms of reference of the new Committee are as follows, but pending the consideration by Parliament of the Bill for the creation of Secretaries of State for Trade and Local Government, they can only be considered as of a provisional character:—

"To advise the Board of Trade on the work of their commercial intelligence branch, and on such matters relating to foreign tariffs and other commercial questions as the Board may refer to them.

"To improve the means of obtaining and diffusing information for the benefit of British trade by means of commercial missions and correspondents abroad, and otherwise as they may think fit.

"The chairman of the Committee will be the President of the Board of Trade.

"Mr. U. F. Wintour will act as secretary to the Committee."

Bankruptcy Proceedings.—Albert John Harris, Bradford.—The meeting of creditors was held on Tuesday, when Mr. E. B. Rawlinson, chartered accountant, of Bradford, was appointed trustee, with a committee of inspection composed of Mr. William Mitchell, accountant, Bradford, Mr. John Steel, of Garnett's Cable Co., Bradford, and Mr. Frederick Arthur, of Bradford.

William Jefferson.—In the Stockton-on-Tees Bankruptcy Court on Friday, William Jefferson, electrical engineer, of 69, Skinnergate, Darlington, and Kingsley Chambers, Bishop Auckland, filed his petition, and receiving and adjudication orders were made.

Natal.—The official trade returns for the six months ended June 30th last show that the following goods, among others, were imported into the colony. The figures in parenthesis are for the corresponding period of 1904, and are given for the purposes of comparison:—Electrical fittings, £18,954 (£17,038); electrical machinery, £113,037 (£61,385).

Trade Announcements.—Messrs. Balcke & Co., 27, Clement's Lane, London, have opened new offices in Newcastle and Glasgow, and have appointed Mr. J. E. Weyman their sole representative for the North of England and Scotland.

The name of the "Utility" Co., Ltd., Britannia Electric Lamp Works, Seven Sisters Road, South Tottenham, N., having been changed by special resolution, it will in future be known as "The Britannia Electric Lamp Works, Ltd."

Messrs. B. Weaver & Co., manufacturers of the "Ebonestos Insulators," of 22, Rosoman Street, E.C., will in future trade as the "Ebonestos Manufacturing Co." at the above address; the *personnel* of the business will not be altered in any way, but will continue to be under the joint management of Messrs. Bernard Weaver and John B. Alexander.

Electricity in Spanish Mills.—We referred in our issue of December 2nd, 1904, to the decision of the Marquess of Larios, the proprietor of La Aurora and La Industria Mills at Malaga, to adopt electric driving throughout. As then stated, Messrs. Mather & Platt, Ltd., of Salford Iron Works, Manchester, were successful, in the face of severe competition, in obtaining the contract for the transformers, motors, switchboards, and accessories, and we recently learn that the whole of the plant has been delivered and erected. La Aurora Mill has now been at work for some weeks with most satisfactory results. The replacement of the steam engines, driving through gear and belts, by motors driving direct on to the line shafts has reduced the power consumption by 40 per cent.; and in the spinning mill, the steadier electric drive has increased the yarn production by 20 per cent., owing to the avoidance of yarn breakages. Naturally, such striking results would hardly be realised if the comparison were made with a modern Lancashire mill, with the engine driving direct by ropes on to the line shafts; but even so, the results obtained at the Heasendford Mill, Burnley, equipped by Messrs. Mather & Platt, Ltd., have demonstrated a very material saving in power and increase in production. The 72 motors supplied by Messrs. Mather & Platt, Ltd., for the mills at Malaga are for three-phase currents; they vary in size from 15 to 150 H.P., and aggregate 2,350 H.P. The average efficiency is 91·1 per cent., and the average power factor 88·1 per cent. The electrical energy for driving these mills is transmitted a distance of some 20 miles, at a pressure of 25,000 volts from the power station of the Sociedad Hidro Electrica del Chorro, which has installed a water-turbine station of some 2,000-H.P. capacity in the Chorro Gorge. Spain, however, especially Andalusia, has a very limited rainfall, and in such seasons as the present the water supply is inadequate for the growing demands of the company, which, in addition to providing power for the mills, is also supplying current to the tramway company, the two electric light supply companies already established in Malaga, and other industries. To meet the deficiency in the water power, the Chorro Co. has therefore decided to install in the city of Malaga a reserve steam station of 2,000 B.H.P. Various prime-movers were considered, and it was ultimately decided to adopt steam turbo-alternators, in two units each of 1,000 H.P. Proposals were called for from the principal firms in Germany, Switzerland, France, and England, and it is gratifying to learn that in face of the cosmopolitan competition, the contract, which includes boilers, steam turbo-alternators, rotary converter, switchboards, and piping has been obtained by the same British firm, Messrs. Mather & Platt, Ltd., which has equipped the Malaga Mills. This installation will be one of the first steam turbine stations in Spain, and much interest will attach to it, as the turbines will be of the Zoelly type, the construction of which in Great Britain and the Colonies has been secured by Messrs. Mather & Platt, Ltd., under exclusive license.

Catalogues and Lists.—The British Electric Calibrated Fuse Co., Ltd., 14, Golden Lane, E.C.—This company will shortly be issuing a new illustrated catalogue and text-book on fuses and safety devices. To do service until this appears, they have just issued leaflet No. 21B showing their various types of fuses.

Hart Accumulator Co., Ltd., Marshgate Lane, Stratford, E.—Illustrated price list (1905) of storage batteries just issued. It is finely produced, and in the course of 30 odd pages gives up-to-date description and other information regarding all the latest types of Hart cells for lighting, traction, central station and motor service, also instructions for erection and working. In addition to the "C.T." type cells for motor-cars, the company now makes two other types which are exactly similar in construction, differing in dimensions only, in order to suit the varied requirements of motor-car builders.

Messrs. Wallach Bros., 57, Gracechurch Street, E.C.—Copy of their 1905 novelty list detailing, among other things, the W.B. portable electric drill, electric bells, flue welding furnaces, double swivelling machinists' vices, gear grinders, spray pumps, brazers and forges, paint burners, railway joint heaters. Numerous illustrations appear and prices are given.

The Birmingham Electrical Fittings Co., Ltd., Baskerville electrical Works, Broad Street, Birmingham.—Small illustrated and priced catalogue of electrical specialities, including fuseboards, distribution boards, tumler, main knife, cast tongue and other switches, switchboards, ceiling roses, and counterweights. Among new features in the list, we observe the block type fuseboard which has recently been introduced. It has solid block contacts. Each pole is mounted on slate, enamelled on the face, back and edges, and separated by an insulating dividing bar. The case is made of teak, french polished.

Messrs. J. J. Smith & Co., 46A, Holborn Viaduct, E.C., and Farm Street, Birmingham.—List relating to a new patent connector and fixing blocks for electric light fittings, by means of which joints behind fittings are obviated.

Mr. A. P. Lundberg, Liverpool Road, N.—Advance copies of new illustrated circulars (1) describing the "Pivot Combination" or the combined tumbler switch and wall connection, and illustrating its various adaptations; (2) very fully particularising the "Pivot Intermediate" switch of the flush and surface types.

Messrs. Siemens Bros. & Co., Ltd., London.—A card has been received relating to the Siemens cable grip, which is fitted with a swivel and patent detachable link, which is intended for use in drawing cables through pipes or conduits.

Messrs. Bergtheil & Young, Ltd., 12, Camomile Street, E.C.—Pamphlet and price list illustrating the Zodel-Voith flexible leather belt insulating coupling, for which they are the sole agents for the United Kingdom. These couplings are much used by the leading engine and dynamo makers in this country, and are particularly useful where the driving and driven shafts are liable to get out of alignment when running. The couplings are also used as safety devices in connection with machines which are liable to very heavy overloads; for this purpose the belt of the coupling is reduced in sectional area, so that when the overload is applied to the driven shaft the belt breaks before any damage is done to gear wheels, &c. The pamphlet gives a description of the construction of the coupling and its applicability. The table gives dimensions, weights, prices, &c.

Messrs. Hudson & Bowring, Ltd., 33, Brazennose Street, Manchester.—An illustrated catalogue fully describing the Hudson-Bowring and Wilson & Bennett life-guard for tramcars.

Messrs. Ernest F. Moy, Ltd., Camden Town, N.W.—Sheet No. 92, describing their type No. 92 shunt regulating resistances.

The Electrical Power Storage Co., Ltd., London, E.C.—New pamphlet giving a proud list of the larger central stations in Great Britain and Ireland for which E.P.S. batteries have been supplied, or are on order A number of half-tone illustrations

appear, showing photographs of some of the more important battery rooms, such as those of the Liverpool Corporation, Liverpool Overhead Railway, Bradford Corporation, Newcastle-on-Tyne, and the Underground Electric Railways Co. of London. Another circular gives prices and particulars of E.P.S. batteries for motor-car and electric launch cells.

The Electrical Co., Ltd., Charing Cross Road, W.C.—A number of new publications have been received as follows:—No. 155, particularising Nernst lanterns for street and shop lighting; 163, showing their patent suspension chain; 166, giving instructions to be observed when fitting up flame arc lamps; 175, briefly describing the L.R. type watt-hour-meters; 176, detailing the G.G. type switchboard and traction meters; 177, showing the new Nernst lamp reflectors for B. and D. type lamps; 178, illustrating some new registered designs of artistic Nernst lamp fittings; 142/62, giving information relating to E.C. small motors, showing their application for various purposes, such as driving drilling machines, polishing motors, sewing machines, and so forth; and No. 146 (A5), illustrating a number of types of E.C. electric fans and ventilators.

The Linolite Co., Westminster.—A copy of the third edition of the company's catalogue, giving details of the now well known "Linolite" system of electrical illumination.

Book Notices.—*Science Abstracts.* Sections A and B. Vol. 8, Part 8. August 25th, 1905. London: E. & F. N. Spon, Ltd. 1s. 6d. net each section.

"The Brassworkers of Berlin and of Birmingham: A Comparison." London: P. S. King & Son. 1s. net.

"National Engineering and Trade Lectures." Edited by Ben. H. Morgan. Vol. II.—"British Progress in Pumps and Pumping Engines," by Philip R. Björling. Vol. III.—"British Progress in Gasworks Plant and Machinery," by C. E. Brackenbury. London: Archibald Constable & Co., Ltd. 6s. net each.

"The East London College Calendar for the Session 1905-6." The East London College, Mile End Road, E.

"Las Redes Eléctricas.—Ensayo Sobre una Teoria de la Distribucion de la Corriente Continua," by A. Guevara. Lima, Peru: The Author, La Curso de Electricidad Industrial en la Escuela de Ingenieros of Lima.

Trattato di Telefonia. By J. Bonnelli and E. Longo. Rome: G. Scotti & Co. 1905.—This Italian treatise on telephony is to be published in 12 monthly parts of 48 pages each, with about 300 engravings, at the price of 1s. each part. The first part, which is before us, contains an index showing an outline of the complete work as follows:—Introduction, telephonic apparatus, telephone lines, aerial, subterranean and submarine, urban service, interurban service, special questions, simultaneous telegraphy and telephony, duplex telephony, telephonic repeaters, telephony without wires, the installation and working of modern telephone exchanges, tariffs, appendix containing notes on the actual condition of telephony in Italy and abroad. The preface states that one of the joint authors—Mr. Bonnelli—published a small book on the same subject in 1898, and in the reviews dealing with his work, it was suggested that it might advantageously be amplified at a later date. This suggestion has been acted upon, and in conjunction with his colleague, Mr. E. Longo, the present work is being published. In the introduction the history of telephony is briefly dealt with. Although many early attempts were made to transmit speech over long distances, the authors remark that the Exhibition of Philadelphia in 1876 saw the first practical appearance of apparatus suited to the purpose, and that it was only after the presentation of Bell's instrument that the public at large began to believe in the solution of the problem. It is the more wonderful that the telephone of to-day is constructed on the same principle as Bell's original model, notice being taken of Bell's later improvement by substituting a permanent magnet with soft iron cap for the original electro-magnet. It may thus be said that the telephone has achieved its present position of utility and importance in a period of about 20 years. The transmission of sound through air is given at 340 metres per second; other comparative figures are given whence it is shown that the report of a rifle fired in Rome would reach London by the telephone in $\frac{1}{100}$th part of a second, whereas by wave propulsion through the air a space of 1½ hours would be required, and whereas the practical limit of distance over which the telephone can be used is governed by the cost of the metallic conductors, transmission through the air of ordinary sound is reduced in proportion to the square of the distance, so that the report of a cannon can be heard at about 30 kilometres, beyond which distance transmission is impossible. Careful and detailed analysis is given of the value of vowels and consonants in telephonic reproduction, and also the limiting number of vibrations caused by voices, ranging from bass to soprano; in general the male voice may be taken to cause 250 vibrations p.s., and the female voice 500, giving the latter great advantage in clearness of repetition. The current generated in a telephone is indicated as such an amount as would be furnished by a Daniell cell connected to an iron wire of 4 mm. diameter, and of sufficient length to make 300 turns round the earth; as such small currents are so easily influenced by external causes, the microphone has been added by which means larger currents can be employed. The original types of microphones are described, and the introduction concludes with reference to the early network at Lowell in 1877 which opened with 45 subscribers, and had a capital of £1,200. In the next chapter excellent descriptions are given of present-day instruments, and their connections are clearly shown in well arranged diagrams. The relations found best in practice between the strength of magnetic field and thickness of diaphragm are considered and explained; then follow details as to construction and possible injuries to which the instruments are liable. The impression formed from the first monthly part is that the complete work will be a most useful volume. It is printed in first-class style, and the diagrams clearly show all the points referred to. The authors show undoubted skill in the subject about which they are writing.

Graphic Methods of Structural Design. By W. W. F. Pullen. Second edition. Manchester: Technical Publishing Company. 1905. Price 5s. net. This is a new edition of the work on the application of graphic and other methods to the design of structures, originally published by the author in 1896. The chapter on Struts has been entirely re-written, and explanatory notes are added in the form of an appendix. The book is full of practical information in convenient form, and should be of value not only to students of engineering, but also to engineers and draughtsmen engaged in the design of structures of iron, wood or masonry. Numerous examples are worked out, with tables of constants and diagrams, and all the usual types of columns, girders, beams, trusses for bridges and roofs, &c., are discussed in detail. The book is well worthy of a place in the well-known series of technical hand books to which it belongs.

National Physical Laboratory.—We have received a list of scientific papers published by the Laboratory, and by members of the staff. References are given to periodicals, proceedings of societies, &c., in which the papers may be found.

Motor-Cell Charging Plant.—The Rhodes Electrical Manufacturing Co., Ltd., is standardising a small rotary transformer, suitable for charging motor-car accumulators. It consists of a double-wound machine suitable for 110 or 230 volts (or thereabouts) at one end, and 4 to 25 volts at the other, the latter voltage being regulated by the rocking of the brushes only. Where electric power is installed, the set is used as a rotary transformer to convert to low voltage for cell charging, and in this case requires no foundation whatever, but will stow away in a corner or under a bench, or will hang from the ceiling. Where electric power is not installed, the machine is belted to the line shaft, and when driven in this manner it will supply high pressure for the pit inspection lamps, as well as the low voltage necessary for accumulator charging. Where electric power is installed it can be used to drive any small machine tool using not more than ½ h.p. at the same time as it is being used for charging purposes. 12 cells can be charged at once, and the set is found to be very useful in automobile garages.

The Electrical Frauds Case.—On Monday at the Guildhall, George Webber, 37, an ironmonger, of Putney, was brought up, charged, with Richard Rosenberg, a chauffeur, also of Putney, in being concerned, with William Leslie and Frances Cheesman, trading as the Electrical Accessories Co., Terminus Chambers, Holborn, E.C., in conspiring together to defraud Messrs. Strode & Co., electricians, of St. Paul's Churchyard, and other electrical firms in London and the provinces, of large sums of money and goods to the value of about £20,000. Mr. Bodkin prosecuted; Mr. Travers Humphreys and Mr. Thorne represented Webber, and Mr. George Kebbell defended Rosenberg. Mr. Merer, the manager of the Fulham Theatre, continuing his evidence, explained how invoices were sent in by Webber, made out to Mr. Henderson, for £11,000 electrical work done to the theatre. This astonished witness, who thought it scarcely likely that so large an amount would be spent in electrical repairs and goods on a theatre that probably only cost £30,000 to build. He inquired how it was that invoices for Henderson should be given to him, instead of to Leslie, who was that gentleman's representative at the theatre, and Webber said he had done so all along, and thought it was right to continue doing so. Leslie left suddenly, on July 19th, without notice. Rosenberg also left the theatre suddenly. Witness admitted that during the four months under consideration a good many arc lamps, switchboards, &c., were taken into the theatre. William Henry Archer (City manager of Strode & Co., electrical engineers, of St. Paul's Churchyard), deposed as to his first interview with Leslie, who said he was the electrical engineer for Fulham Theatre. He wanted a lot of fittings for the theatre. The goods were to be ordered through Webber, ironmonger, of High Street, Putney, and he called, by his authority. Witness told him they would be willing, if Webber's references were satisfactory. These were given, and having proved satisfactory, they wrote Leslie that they were willing to execute the order for Pognon sparking plugs, which Leslie had told him could only be obtained from the Electrical Accessories Co. He ordered from the Accessories Co., and was supplied, and he then forwarded them to Webber. Leslie had told him the sparking plugs were for unusual electrical effects at the theatre. Eventually, invoices were received from the Accessories Co. He received a pressing application from the Accessories Co. for £259 15s. 9d. At the same time, he was pressing Webber for payment. Webber told him he would receive payment as soon as he received the cheque from the theatre. On July 8th he received a cheque from Webber for £331 2s.; this was dishonoured. His firm had paid the Accessories Co. The case was again adjourned.

Hughes's Atlas Works, Ltd.—In the Vacation Court on Wednesday, September 6th, before Mr. Justice A. T. Lawrence, Mr. Gaveen appeared in support of a motion for the appointment of a Receiver in the case of the Trust Co., Ltd. *v.* Hughes's Atlas Works, Ltd. The respondent company, he said, was an electrical, gas and engineering company, and plaintiffs were holders of 20 debentures of £50 each. It was desirable to appoint a receiver and manager to protect the property of the company, and he asked his Lordship to appoint Mr. Fox chartered accountant. Counsel for the company consented, and Mr. Fox was accordingly appointed receiver and manager.

LIGHTING AND POWER NOTES.

Aberdeen.—The accounts of the electricity department for the year ended July 31st have just been issued. The total capital expenditure at that date amounted to £237,447, £23,427 having been spent during the year. The total revenue for the year amounted to £39,048, and the working expenditure to £17,038, leaving a gross profit of £22,010. Out of the latter, payments of £7,695 for interest, £4,891 to the sinking fund, and £6,723 for depreciation were made, and the surplus of £2,754 was added to the reserve fund. During the year the electricity department sold 4,069,831 units, compared with 3,539,026 in 1904; of this amount, 2,105,279 were for traction, 1,709,012 for private consumers, and 255,540 units for public lighting. The total number of public arc lamps in use was 127.

Aldrington.—The Brighton Corporation agreed some time ago to supply energy in bulk in this portion of Hove, from its new power station, and on August 31st the new supply was inaugurated.

The Hove Corporation are responsible for the distribution, and some five miles of mains have been laid.

Barnsley.—The T.C. has applied for a loan of £3,000 for the extension of E.L. mains and services, and the purchase of motors.

British Columbia.—The B.C. Electric Railway Co. has decided to carry out an electric lighting, power and traction project at North Vancouver at a cost of £40,000. The existing generating plant will be increased from 9,000 to 12,000 H.P.

Chertsey.—The R.D.C. has been requested by Windlesham P.C. to oppose the application of Messrs. Foote & Milne for a prov. order to supply energy in the district, owing to the unsatisfactory terms offered. The R.D.C. has decided to communicate with the firm in question.

Continental Notes.—ITALY.—A company has recently been constituted to work the lignite deposits in Valdarno. It is intended to erect a generating station on the property, and to distribute electrical energy throughout the province of Tuscany. This has the appearance of following on the lines of the electric power companies established in this country on the coal fields.

A concession has been asked for, to authorise the deviation of a portion of the water of the River Adda, with a view to the establishment of generating and distribution works for the provinces of Sondrio and Como.

La Societa Industriali Italiana, recently formed in Rome, has secured a concession to put down a plant to utilise the water-power of the river Tronto, in the province of Ascoli-Piceno, in the generation of electrical energy for power purposes. It is stated that no less than 20,000 H.P. will be available.

The Electrical Power Co., of Lombardy, at an extraordinary meeting of shareholders, decided to increase the capital of the company from £440,000 to £600,000, leaving the directors to call the further capital when required.—*L'Elettricista.*

BELGIUM.—La Société de l'Isothermie is the title of a company which has just been formed at Mons, with a capital of £4,800, to construct plant for the generation of energy for power purposes.

FRANCE.—A central electric lighting and power station is being established at the Naval Arsenal in Brest.

Cramlington.—The U.D.C. on Monday discussed the E.L. question, and after interviewing Mr. Laws, of the Newcastle and District Electric Supply Co., who asked for the Council's support to the company's application for a provisional order, the matter was deferred for a month.

Dundee.—The Tramways Committee has favourably considered a proposal by the electrical engineer that arrangements should be made for utilising certain tramway feeders for the supply of energy for power purposes only, to industrial establishments on the side of the tramway route.

Egham.—With reference to Messrs. Foote & Milne's application for a prov. order for E.L., the U.D.C. has informed the local E.L. syndicate that it has no intention of assenting to the application.

Hamilton.—An electrical exhibition, to last from September 7th till the 16th, has been promoted by the Burgh of Hamilton Electric Supply Co. The exhibition has been organised by Messrs. Edmundson's Electricity Corporation.

Hanley.—The Fenton U.D.C. has decided that it would not pay to lay cables for the purpose of obtaining a bulk supply of electricity from the T.C. The official trial of the new Howden-Westinghouse (No. 1) set has taken place satisfactorily.

Heswall-cum-Oldfield.—Messrs. Robinson & Carter, electrical engineers, of Liverpool, have informed the P.C. that they intend applying for E.L. powers for that parish.

Liversedge.—The U.D.C. has decided to canvass the proposed area of supply in connection with the E.L. scheme, in order to ascertain the probable number of consumers for light and motive power.

London.—BERMONDSEY.—The B.C. has decided to revise the charges for electrical energy as follows:—For power purposes, 1½d. per unit, for the first four hours' average daily use of the maximum demand, and ¾d. per unit afterwards; for lighting purposes, 6d. per unit for the first hour's average daily use of the maximum demand, and 2d. per unit afterwards, instead of 6d. and 3d. as at present; the flat rate of 4½d. to remain as heretofore. All persons now under agreement will have the opportunity of coming under the revised scale as from October 1st.

The Electrical Committee hopes to make the Council a rebate on the year's supply of ½d. per unit. Instructions have been given the electrical engineer to investigate the charge for lighting large institutions of all classes in the borough, as well as the present flat rate of 4½d., and to report to the Committee thereon. The valuation of the electric light and destructor premises has been increased in the Valuation List, 1905, as follows:—Electricity works, gross £1,297 at present, raised to £2,693; rateable, £865 at present, raised to £1,796; dust destructor, gross £963 at present, raised to £1,075; rateable, gross £803 at present, raised to £896. The Council considered the new assessment fair, and approved of same.

MARYLEBONE.—With reference to our note under this heading last week, we are informed by Mr. F. A. Wilkinson, the Council's electrical engineer, that their new generating station has been in operation for a month, and that nearly 4,000 consumers have been taken over from the Metropolitan Electric Supply Co.

Arrangements for taking over the remainder of the consumers, and for changing the pressure of the existing installations, are being rapidly proceeded with.

CITY.—The City of London Guardians have decided to enter into a contract with the Charing Cross, City and West End Electricity Supply Co. to supply electric light to the Guardians' offices and Thavies Inn for five years at 2½d. per unit. The price now charged is 3½d. per unit, and under the proposed arrangement a sum of £74 per annum would be saved.

Malton.—The Northern Counties Electricity Supply Co.'s new generating station is nearing completion, and it is expected that a permanent supply will be available in a month's time.

New Zealand.—TIMARU.—Subject to a satisfactory arrangement of details, the Borough Council has accepted the offer of Scott Brothers, of Christchurch, to install an electric plant to light the streets, giving a total of 24,300 C.P. for £750 a year. The price is equal to 3½d. per unit, extensions *pro rata*; energy will be supplied to private consumers at not exceeding 1s. per unit for light and 4d. for power. The Council is to have the right of purchase on stated terms.

Pwllheli.—At a recent meeting of the T.C. it was decided to abandon the idea of an electric scheme, for which a provisional order was secured some years ago, and to lend every facility to a Huddersfield syndicate, who are about to apply for a provisional order.

Seaton.—A curious deadlock has arisen here. An Exeter firm of electrical engineers has signified its intention of applying for an order to provide electric light. In the course of the discussion the members were reminded that, in accordance with a clause in the Local Government Act, any member holding an interest in a gas company would be debarred from speaking or voting on the subject. The clerk pointed out that, in that case, there would not be a quorum left to consider the matter, and it would be, consequently, impossible for the Council to enter into any agreement or pass any resolution. The representative of the firm replied that, at any rate, the Council would be prevented from opposing the application for the order. The subject was necessarily left in abeyance.

South Africa.—JOHANNESBURG.—The Municipal Council has sanctioned a scheme for the extension of the existing electric lighting plant at Bertram's Town, which will involve an expenditure of £2,600. This includes £700 for the feeder mains, the whole of which could always be utilised elsewhere. It is estimated that the total cost of a year's working would amount to £3,275, and that the revenue for the year would be £4,366, leaving a profit of £1,091.—*South Africa.*

South Shields.—At a recent meeting of the Corporation Electrical Committee, a letter was received from the Durham Electric Power Distribution Co., Ltd., offering to lease the Corporation's electrical undertaking for 30 years at an annual rental of £6,000, and to supply energy in bulk to the Council at 45d. per B.T.U., plus a fixed annual charge per KW. The Committee has decided not to negotiate for the sale or lease of the undertaking.

Torquay.—The vexed question as to whether a new generating station costing £42,000, or an extension to the present station, shall be carried out in order to supply energy for the Dolter Tramways, has been practically settled. The Council, after practically adopting the extension scheme, called in Mr. J. E. Waller (London) to report on it. The latter gentleman having generally confirmed the report, the E.L. Committee has decided to recommend the T.C. to sanction a loan of some £9,500.

United States.—PENNSYLVANIA.—Fifteen electric light companies near Harrisburg have recently combined with a total capital of $1,000,000.

NEW YORK CITY.—The New York Edison Co., which controls the electric lighting of almost the entire city, and especially of Manhattan, has ordered two new 9,000-KW. Curtis steam turbine generating units. The largest sets at present operated by the company are of 8,000 KW. capacity. The new sets will occupy floor space equivalent to a circle less than 16 ft. in diameter each, and will be housed in the Waterside station.

TRAMWAY AND RAILWAY NOTES.

Continental Notes.—Italy.—The representatives of the Italian Siemens-Schuckert Co. are seeking powers to construct an electric tramway between Mestre and Spresiano, in the vicinity of Venice.

An agreement dated June 20th has been entered into between the municipal authority of Verona and the tramway company at present operating a system of horse-drawn vehicles, whereby the company undertakes to construct two new routes and to equip the whole system electrically. The concession is for 30 years, with terms of purchase at intervals of 10 years.

From October 15th, 1903, to October 14th, 1904, the electric trains on the Valtellina Railway ran 794,000 kilometres; the usual passenger trains consist of from six coaches, having a total weight of about 140 tons, up to 16 coaches, weighing 250 tons. Goods trains consist of 20 to 30 wagons, with a total weight of 400 tons. 54 trains pass up and down the line during the day, against 28 which were able to be worked when previously using steam. In the near future the number is to be increased to 60. The following table shows the relative working costs:—

	Total cost, liras.	Kilometres run.	Cost per train kilometre.
Steam ...	809,379	347,776	2·3773
Electric ...	1,273,120	794,373	1·3509

The chief Italian railways pass under State control as from July 1st last. In commenting on this transfer in a leading article, *l'Elettricista* (Rome) remarks:—"Once this great misfortune has occurred, we, as Italians, can only hope that the least possible inconvenience may result."

Holland.—The work of converting the tramways in Rotterdam is making good progress, the first section having been opened for traffic.

Glasgow.—On Saturday afternoon a car was proceeding down a steep incline near Dawson Road, when it rushed into a heavily-laden lorry in front of it. The horse yoked to the lorry was killed outright, while the car driver was rendered unconscious. The lorry driver and his son were cut and bruised, and seven car passengers were more or less injured, but, fortunately, not seriously. The accident is attributed to the failure of the brakes to act.

Ipswich.—On August 30th a L.G.B. inquiry was held relative to the Corporation's application for a loan of £19,500 for street improvements in connection with the reconstruction of the electric tramways. The work has already been carried out, having been completed last year. There was no opposition.

London.—The L.C.C. has put in hand the section of electric tramway between New Cross and Lewisham. The line may later be extended to Catford, and after that to Bromley and Bickley and onwards.

United States.—Adirondack Mountains.—The new electric car lines in the Ticonderoga section of the Adirondack Mountains, N.Y., are to be used during the winter for hauling timber, and to this end powerful cars with 200-h.p. motors have been ordered.

Buffalo.—The Tractional Co., with a capital of £20,000,000, has been formed to acquire the entire stock of the International Traction Co., owning the chief electric car lines in Buffalo. Mr. Henry J. Pierce, president of the I.T. Co., will also be president of the new concern.

Chicago.—Plans have been published for a 264-mile municipal tramway system. The mileage represents both existing and projected lines; and to complete the work is estimated to cost about £5,000,000. It has been discovered that some portion of the recently-constructed tunnelling has become unsafe, and the fact is attributed to the non-use of compressed air in building.

New York City.—The report of the Interborough Rapid Transit Co., which owns both the subway and the elevated lines in Manhattan, shows that there was a falling-off of 2,544,000 passengers during the quarter ending June 30th. The decrease is attributed to the warm weather and to the unpleasant atmospheric conditions in the subway, which, however, have been considerably alleviated by putting in exhaust fans at the chief stations. The New York Edison Co. announces that it is now supplying electricity for power purposes on Manhattan Island equivalent to 98,000 h.p. Plans have been matured for constructing a large terminal for electric trolley cars at the end of the Williamsburg Bridge. There will be eight loops, occupying a space of 600 × 129 ft.

Pennsylvania.—A financial syndicate has applied for charters for a subway system for Pittsburg, to involve an outlay of £2,000,000. A power scheme, also involving an outlay of £2,000,000, has been announced for Yorktown, on the Susquehanna River, from which power will be distributed as far away as Philadelphia and Baltimore.

Pennsylvania Railroad.—This company, in addition to its interest in a tunnel for electric traction across New York City to connect its trans-Continental lines with those of the Long Island railroad, is also surveying with a view to perfecting a subsidiary electric trolley line for goods service between Jersey City and Philadelphia. The New York and Philadelphia Traction Co., which is another name for the Pennsylvania Railroad, has acquired interests in several existing electric passenger lines along the route, and the survey is for the purpose of linking all into one.

South Shields.—At a meeting of the Tramways Committee on the 4th inst., it was decided to recommend the Council to combine the offices of tramway manager and electrical engineer, and to offer the dual position to Mr. J. H. Cawthra, the present electrical engineer, his salary to remain without alteration for 12 months. It was proposed to recommend that a traffic manager be appointed under Mr. Cawthra.

Penmaenmawr.—A project is on foot for the construction of an electric railway up to the top of the Green Gorge, 1,200 ft. above sea level, giving access to the mountain lands. It is proposed that the U.D.C. shall raise temporary loans without interest to carry out the work, the Council having reached the limit of its borrowing powers. In five years certain existing loans will have been repaid, and the Council will then be in a position to apply for the sanction of the L.G.B. to a loan.

TELEGRAPH AND TELEPHONE NOTES.

Accident to the s.s. "Colonia."—The *Halifax* (N.S.) *Morning Chronicle* states in reference to the stranding of the cable steamer *Colonia*, that she arrived safely on the afternoon of August 25th, and went into dry dock for repairs. Her damage is nearly all near the bow, and on the way up from Canso she made some water, but the powerful pumps on board kept her free. The steamer *Havana*, which rendered valuable assistance in floating the *Colonia*, found her lying on a narrow rough ledge of rocks which extended out some distance from the west of Fox Island. The ship was resting on the ledge amidship with a list to port and considerably down by the head with No. 1 hold full of water, which had risen to within 2 ft. of the top of No. 1 cable tank. Openings had to be cut in the steel decks to get the suction pipes into the lower hold. It is also stated that the ship would, there is little doubt, have broken her back had the sea been rough.

African Telegraphs.—A new line has been opened between Porto Novo and Sakété (Dahomey), and the telegraph office at Jebba, Nigeria, has been closed.

Japanese Cables.—During the severe typhoon which raged over the East China Sea at the beginning of the month, six cables were damaged, including the Shanghai-Chifu and Shanghai-Nagasaki cables. Communication with Japan was temporarily interrupted at the beginning of this week, but on September 6th the Great Northern Telegraph Co. announced its restoration between Shanghai and Nagasaki.

Murray Telegraphy.—It has been decided by the authorities at the General Post Office to install Murray instruments for telegraphic purposes between London and Dublin.

Submarine Signalling.—Further experiments in submarine signalling took place in the Channel on the 24th ult., between the Trinity yacht *Irene* and the North Goodwin Sands lightship, and were remarkably successful. The demonstrations were made in the presence of a large number of the brethren of Trinity House and others. The various signals were heard with greater distinctness than at the previous trial, and continued to be audible up to a distance of 5 or 6 miles.

Telegraphic Interruptions and Repairs:—

Cables.	Interrupted.	Repaired.
Trinidad-Demerara (No. 1)	Aug. 26, 1901	
Dominica-Martinique	May 7, 1902	
St. Lucia-Martinique	May 7, 1902	
Cayenne-Pinheiro	Aug. 13, 1902	
Reissa-Issa (Yemen) Camaran	Oct. 22, 1902	
Closed { Vladivostock-Nagasaki	Feb. 9, 1904	
Closed { Port Arthur-Chifu	Mar. 9, 1904	
Tarifa-Tangier	Jan. 18, 1904	
Jamaica-Colon	Jan. 5, 1905	
Bolama-Bissao	June 21, 1905	Sept. 1, 1905.
Iquique-Antofagasta	July 21, 1905	
Cadiz-Tenerif	July 20, 1905	
Shanghai-Nagasaki	Sept. 2, 1905	Sept. 6, 1905.
Landlines.		
Puerto-Barrios	July 28, 1902	
Kertch-Soutehoum	Sept. 27, 1904	
Alaska landlines	Aug. 27, 1905	
Communication with Brazil *via* Galveston	July 18, 1905	

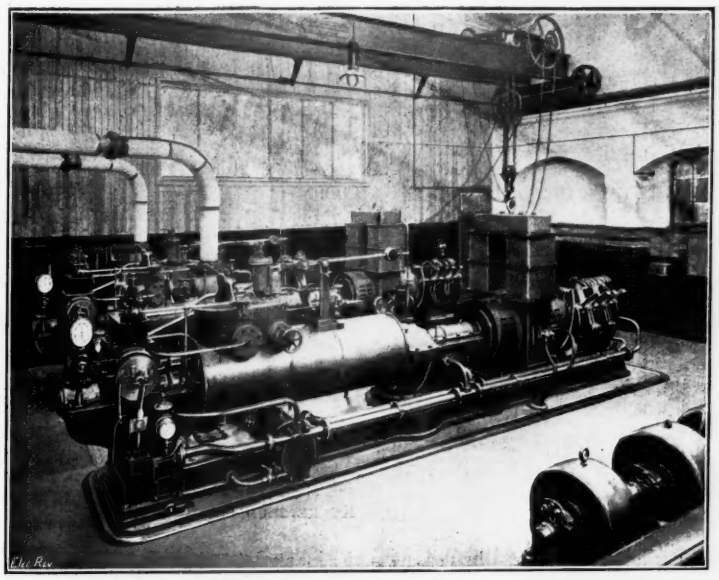
Telephone Conference.—A conference of those municipalities which own telephone enterprises will shortly be held, with the object of discussing the future of these undertakings. The question is whether it is advisable to accept the invitation of the Postmaster-General to negotiate for the transfer of the undertakings, or to continue the competition.

Telephone Regulations.—The Post Office circular states that local intercommunication calls may be interrupted at the expiration of 3 minutes, not 6 minutes as before stated, if other calls are on hand, or if the wires are required for any other purpose.

(*Continued on page* 387.)

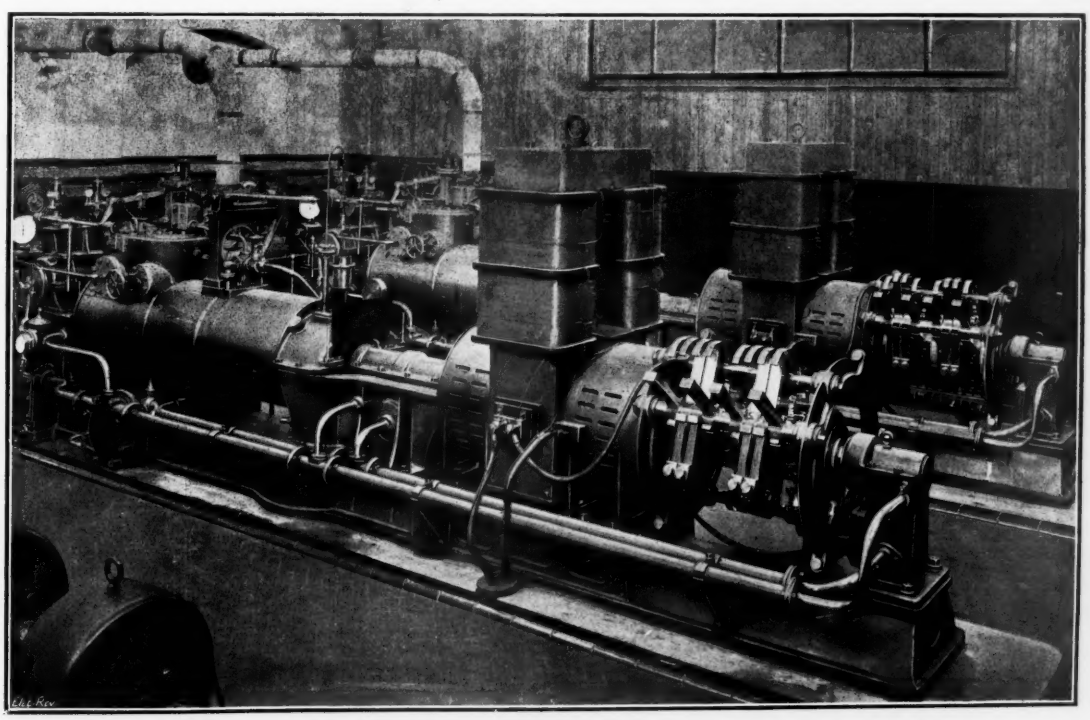
GENERATING PLANT IN LOUGHBOROUGH ELECTRICITY WORKS.

The present-day tendency to install turbine-driven dynamos in generating stations, even when the units are of comparatively small size, is well exemplified by the Frome electricity works, recently described, and the plant installed at Loughborough. Whether it is altogether advisable to adopt the turbine for generating sets of less than 400 or 500 KW. output is a disputed point; the excellent high-speed reciprocating engines that are available nowadays leave little to be desired in point of economy, and therefore we presume that other considerations guided the engineers responsible for the adoption of turbines in these two instances. It cannot be denied that there is a seductive simplicity about the turbine, which requires the minimum of attendance, and like the famous Willans engine, cannot even be inspected internally whilst running. In the former, it was once said at a meeting of the I.E.E., there were three holes—one to put steam in, one to let it out, and one to pour oil in: the turbine goes one better, for it dispenses with the oil hole.



General View of Generating Plant.

The generating plant installed in the electricity works of the Loughborough Corporation last year consists of two turbo-dynamos of the Parsons type, made by the Brush Electrical Engineering Co., Ltd., of Loughborough, together with the necessary condensing apparatus, &c. Each of the turbo-dynamos is rated at 250 KW.—568 to 522 amperes at 440 to 480 volts—and is of the two-pole shunt-wound type, with armature running at 3,000 r.p.m. The armature is of the smooth core drum-wound type, well ventilated with axial channels, and wound with stranded rectangular copper conductors. The commutator is of the turbine type evolved by Messrs. Parsons, and the brush-holders are of their improved gravity pattern. The turbine works at a steam pressure of 150 lb. per sq. in., with a superheat of 150° F., and the set is capable of withstanding an overload of 25 per cent. for one hour.



Brush-Parsons 250-KW. Turbo-dynamos.

The condensing plant consists of a surface condenser, having a cooling surface of 1,350 sq. ft., a two-throw

Edwards air-pump, and a centrifugal pump capable of delivering 1,100 gallons of water per minute against a total head of 20 ft. The condenser is placed between the two turbines, so that either, or both, can exhaust into it, as desired. Provision is also made for discharging the exhaust steam into the atmosphere in case of need. The pumps are rope-driven by Brush "E" motors, carried on brackets on the wall of the engine room floor; this arrangement not only ensures more effective supervision than they would receive if they were in the condenser pit, but also removes all risk of damage by flooding.

The steam consumptions guaranteed for the turbines, under the conditions of steam pressure and temperature above-mentioned, and with a vacuum of 27 in. (out of 30) of mercury, were, at full load, 21 lb. per KW.-hour, and at half load 24 lb. At the official trials these figures were much improved upon, the actual results being 19·9 lb per KW.-hour at full load (530 amperes at 475 volts), with a vacuum of 28·5 in. (out of 30·25), and a superheat of 180° F. Having in view the small size of the turbines, the results are very satisfactory.

The station commenced supply last December under the direction of Mr. W. H. Allen, the borough electrical engineer.

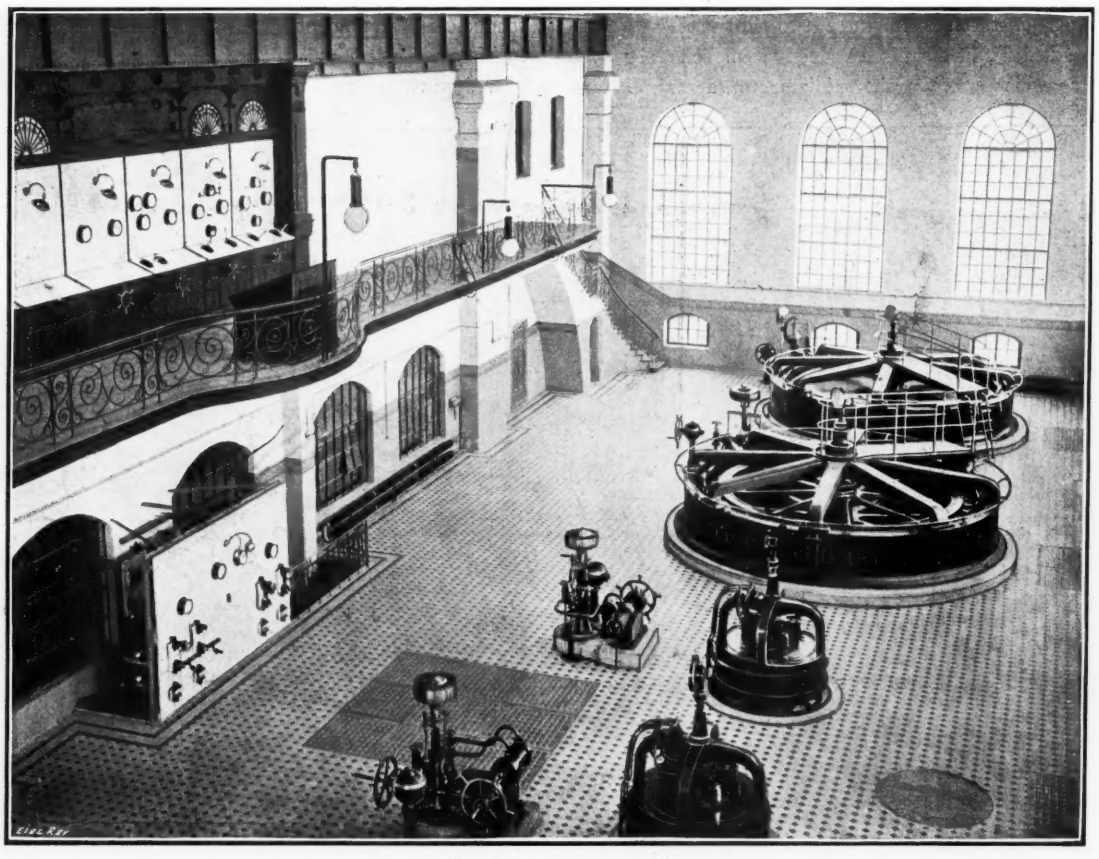
A NORWEGIAN HYDRO-ELECTRIC POWER PLANT.

By DR. ALFRED GRADENWITZ.

NORWAY, which among the European countries is possibly the richest in water, is traversed by a multitude of sinuous waterways which, pouring down from the summits of the high mountains, now run swiftly in a narrow bed and now widen themselves out to lakes of sometimes considerable area, there to go on quietly until they are received by one of the numerous fjords which, like the arms of polyps, deeply penetrate into the country.

If these tremendous masses of water, with their falls and currents, afford delightful scenery to the amateur of

KYKKELSRUD POWER STATION.



INTERIOR OF GENERATING STATION.

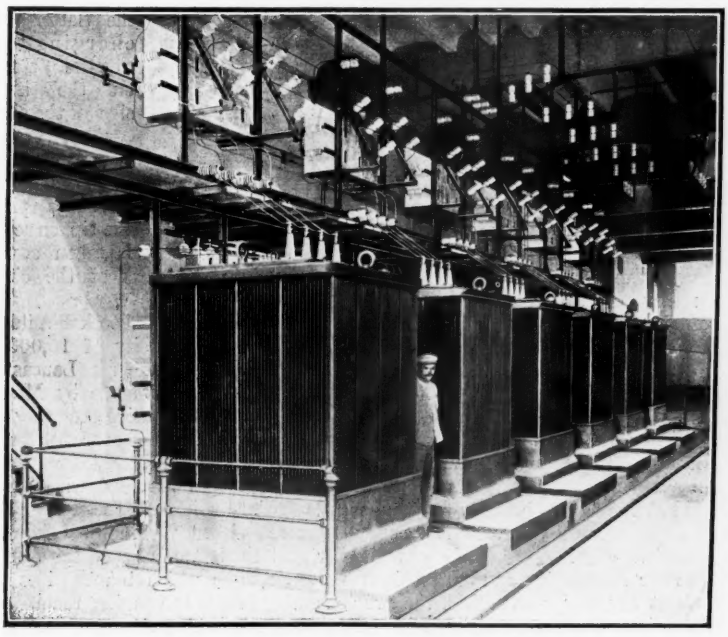
nature, they, on the other hand, place important problems before the engineer, who is naturally desirous of converting into useful work the energy of nature which here goes to waste, and of employing it for the purposes of civilisation.

The advances made in connection with the electrical transmission of energy, the numerous uses that electrical energy is susceptible of in industry, and the advantages inherent in water-power (as compared with the mechanical work derived from coal, liquid fuel, &c.) of being independent of any oscillations in the industrial market, necessarily point to the utilisation of the available water-power to the utmost.

One of the largest electrical power schemes utilising the water-power of Norway is the Kykkelsrud plant on the Glommen River, which was recently installed by the Aktieselskabet Glommens Traesliberi, in conjunction with the electricity company, formerly Schuckert & Co., of Nürnberg, Germany.

The Glommen is one of the largest and most powerful rivers of Norway; its range extends approximately from Trondhjem in the north to Frederiksstad in the south, where it terminates in the Christiania Fjord. Many inland lakes are included in the drainage area of the Glommen, the largest of which, viz., the Mjösen lake, has an area of 359 sq. km., and lies at 123 m. above the level of the sea, its maximum depth being about 450 m. To the south of this lake at about 60 km. distance is the Oejeren lake, lying at about 103 m. above the level of the sea, and communicating with the former through the Glommen, which on issuing from the Oejeren lake forms a number of rapids and waterfalls, having an aggregate head of about 75 m. over a distance of about 20 km., and including the Kykkelsrud Falls. This lies at about 63 km. from Christiania, and is owned by the Traesliberi Co., its total head being 19 m. A head of 9 metres, and an amount of about 40 cb. metres of water per second, had been employed by the company for several years to operate a wood polishing factory, a grinding-mill and a saw-mill.

In order to utilise the total head of 19 m., the construction of an electricity works was decided on, the intention being to make use of 260 cb. m. per second on the average. The generating plant was to be installed in a turbine house, which together with its accessory buildings had at the outset

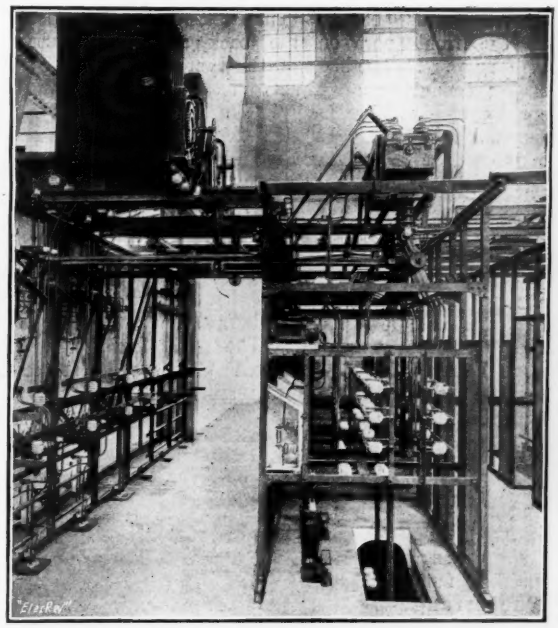


20,000-volt 950-k.v.a. Transformers.

to afford accommodation for four turbine sets of 3,000 h.p. each and for three sets of 280 h.p. each, while the southern part of the turbine house was to receive three additional turbine sets of 5,000 h.p. each, and the northern part five sets of the same magnitude, should this prove necessary.

The first installation, carried out under considerable difficulties due to the unfavourable climate and to the peculiar hydrographic conditions, was completed in September, 1903.

The two three-phase generators installed in this electricity works are driven by two turbines of 3,000 h.p. each, one of which has been constructed by Messrs. Esher, Wyss & Co.,



Generator Oil-switches, &c., Behind Apparatus Board.

of Zürich, while the other, as well as the two 280-h.p. turbines used to drive the two dynamos serving for the excitation of the alternators and for lighting purposes, has been supplied by J. N. Voith, of Heidenheim.

The exciter dynamos have an output of 182 kw. each, and are connected up to a small distribution panel beneath the switchboard gallery, where all the machines are connected to common bus-bars. From these bus-bars are branched off the circuits leading to the various places of consumption. Both the output and the pressure can be observed, and the latter regulated, from this distribution panel, as also from a distribution desk placed at a height of 5 metres.

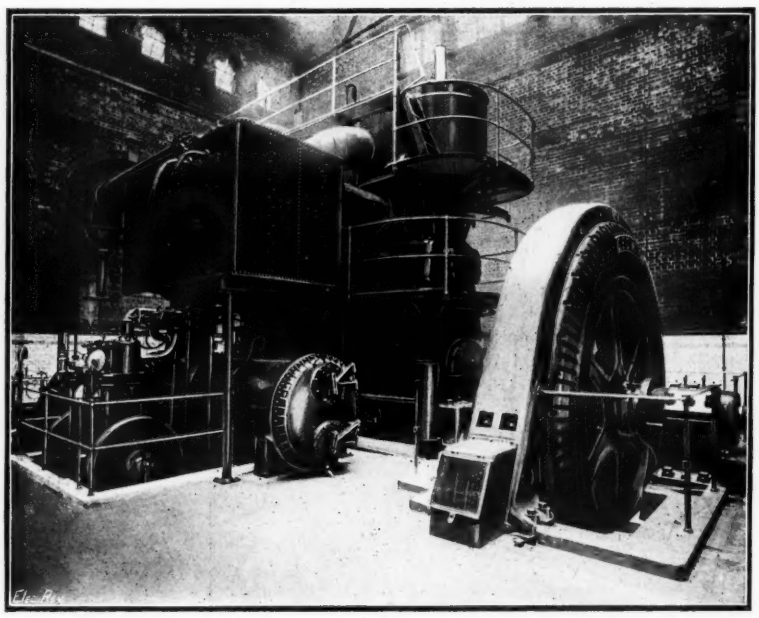
Each of the three-phase generators yields 2,500 kw. with a power factor of unity, and 2,500 k.v.a. with a power factor of ·8, while allowing fully for such overloads as are specified by the German Association regulations. The magnet-wheel has 40 poles and turns at 150 r.p.m., giving a frequency of 50 periods per second.

The switchboard in its present state of construction is sufficient for four generators and four transmission lines at 20,000 volts working pressure. In the front part are the four generator panels and a central panel for the transmission lines. On each generator panel are situated the instruments used for measuring the current and pressure, as well as the synchronising voltmeters and phase lamps. On the table-shaped projection are two hand levers, and underneath the hand wheel for the regulation of the generator field current. The central panel of the board contains measuring instruments for the transmission line (20,000 volts), in addition to the switch levers of the corresponding oil switches, and two hand wheels which are coupled to shafts situated inside the table-shaped projection just

referred to. The pressure is so regulated by the two hand wheels that each controls the generators belonging to either of the two bus-bars. Special care has been bestowed on a safe and simple arrangement and connection of the apparatus and conductors behind the apparatus board. All switches, fuses, pressure and current measuring transformers, as well as all conductors carrying high pressure, are placed in special iron frames and are separated from the apparatus board. The latter includes neither on the front nor on the back any parts carrying high pressure. The back of the board is taken up by the exciter conductors and by the measuring circuits of the current and pressure transformers leading to the corresponding meters. In addition, there are at the top the rods of the regulating resistances for the generator fields, and the lever system serving to actuate the change-over switches and the 5,000 and 20,000-volt oil switches. At 1·5 m. distance from the wall is placed the iron frame supporting the apparatus and bus-bar sets designed for 5,000 volts (see p. 385). The generator oil switches are placed at the top, and are followed by the corresponding change-over switches, and further down by the bus-bars and the pieces separating these. The measuring transformers have been fixed at convenient places, and the corresponding fuses are mounted on marble sections.

A second iron frame carries the 20,000-volt apparatus and bus-bars, including the transmission line safety fuses. The arrangement of the apparatus and fuses has been made similar to that of the iron frame above-mentioned.

Below the switching room at the back of the apparatus board is the transformer room, which traverses the whole length of the building. In the middle is a tramway, on both sides of which are placed the transformers. Each of these can be installed or exchanged very rapidly by means of a carriage. The transformers are oil transformers with a special patented arrangement of the iron core, giving 950 K.V.A. each at 20,000 volts.



New Belliss-Witton Generator at the Pigeon-house Generating Station.

In order to supply the electrical energy generated in the central station to the remote centres of consumption, the provision of five long-distance lines, four to the north and one to the south, has been contemplated. In a northern direction two rows of poles for two lines of three wires each have been installed up to 63 km. distance, but for the moment they have been taken up only by a single line including three wires of 50 sq. mm. cross-section each. To this is connected an extension going as far as the Slemmestad transformer station, lying at about 87 km. distance from the electricity works, this extension including three wires of 35 sq. mm. cross-section.

Alongside the transmission line seven sub-stations are being erected, where the pressure is reduced from 20,000 volts to 5,000 volts by oil transformers. Energy at this pressure will be supplied to the regions of consumption, there to be used either immediately or after a further reduction to 220 volts by means of small transformer stations.

THE PIGEON-HOUSE GENERATING STATION OF DUBLIN CORPORATION.

The latest generating station of the Dublin Corporation is, as probably our readers know, almost out at sea; that is to say, it is situated at a distance of 3 miles from the city, on one of the breakwaters at the mouth of the River Liffey. This situation, while it facilitates dealing with fuel and water, obviously places the station a long way from the distributing network.

The plant is of a very up-to-date character; outside the boiler house is a travelling crane, provided with a grab, which transfers coal from barges brought alongside a wharf to hoppers conveniently situated on the ground level in the boiler house wall. From these hoppers the coal descends to a travelling bucket conveyor, which automatically weighs it and deposits it in a coal store situated at one end of the boiler house, from which, as required, it is transferred by the conveyor to overhead bunkers situated over each boiler. From the bunkers it is fed through shoots to the automatic stokers. On the wharf side of the boiler house a large screening chamber has been built for use in connection with the condensing water arrangements. Sea-water is taken from the harbour by means of an underground cast-iron pipe, 30 in. dia., provided with special screens at its mouth in the screening chamber; this pipe passes underneath the boiler house, and supplies three 6-ft. diameter wells, from which the circulating pumps used with each of the three surface condensers situated in the engine room draw water, the latter discharging on to the strand on the south side of the site.

By means of water seals at the ends of the discharge pipes, the siphon action is taken advantage of, thus tending to reduce the work of the circulating pumps.

In the boiler house are four of Messrs. Babcock & Wilcox's boilers, each having an evaporative capacity of 10,000 lb. of water per hour; in addition there are six Lancashire boilers, 30 ft. long × 8 ft. 6 in. diameter, made by Messrs. Holdsworth, each having an evaporative capacity of 8,000 lb. of water per hour. The former boilers are fitted with chain grate stokers, the latter with sprinkling stokers of the Bennis type. All of the boilers are provided with superheaters, to give about 150° F. superheat at the engine stop valve. The superheaters are placed within the brickwork surrounding each boiler, and the steam is superheated on its way to the main steam range, from which branch pipes lead to each of the five generating sets in the engine room. At the end of the boiler house is situated a pump room containing four vertical Weir type feed pumps, the capacity of these pumps ranging from 5,000 to 1,500 gallons per hour.

The pumps are placed round a cast-iron feed tank measuring 16 ft. × 8 ft. × 5 ft., which is supplied alternately from a 6-in. Vartry water main or from the air pump discharge, through a coke filter, or from large reserve storage tanks situated outside the building.

In the engine room, five three-phase 5,000-volt generating

sets are installed. Four of these consist of Stewart marine type engines with Corliss valve gear, direct-coupled to Oerlikon three-phase generators, two of the sets having an output of 1,000 KW. and two of 500 KW. The fifth set consists of a Belliss high-speed engine coupled to a Witton three-phase generator, manufactured by the General Electric Co. at their Witton Works, and having an output of 1,500 KW., this set forming the latest addition to the plant. The principal data of these machines are as follows :—

	Oerlikon, 1,000 KW.	Oerlikon, 500 KW.	Witton, 1,500 KW.
Speed r.p.m.	84	94	200
Number of magnet poles	72	64	30
Number of coils per phase	36	32	30
Weight of fly-wheel and magnets in tons	44	33	28
Diameter of magnet wheels in feet	18·3	14·2	13·6

It is interesting to note the increased output obtained from the Witton-Belliss set in spite of its lesser weight, due to the adoption of a much higher speed of rotation (in accordance with British standard practice) than is usually to be found in Continental plants of the same output. The rotating portion of the Witton machine serves at once the purpose of engine fly-wheel and magnet-wheel, the peripheral speed of which amounts to 8,540 ft. per minute. This has necessitated a special construction being adopted, the rim being formed of a solid ring of special cast-steel and the spider or spokes being made of cast-iron and keyed only on the spoke tips to the inside of the steel rim. Further, the shape of the pressure wave generated by the Witton machine conforms much more nearly to a true sine curve, due to the increased number of the slots in which the windings are placed on the inside of the stator. In the case of the Oerlikon generators one slot per pole per phase has been adopted, whereas in the Witton machine two slots per phase occur. This result tends to safety as regards pressure rises on large systems of mains to which generators may be coupled, and obviates a number of complicated phenomena known as resonance effects.

The tests of the new set were made during May last and gave every satisfaction.

TELEGRAPH AND TELEPHONE NOTES.

(*Concluded from page* 382.)

Wireless Telegraphy.—The Chicago and Alton Railway Co. have placed on their expresses between Chicago and St. Louis apparatus for the reception of wireless telegrams during the journey, which should prove useful commercially, as well as being an assurance against accidents. On account of the cost it has been decided not to install dispatching apparatus at present. The work was carried out by the De Forest Wireless Telegraph Co., who have erected stations at Chicago, Springfield and St. Louis, and propose to build one at Bloomington as soon as a decision has been arrived at as to the advisability of continuing the experiment. The maximum range of communication is about 40 miles.

The U.S. Navy Department has announced that wireless communication between U.S. warships has been maintained at sea over a distance of 262 miles.

The World's Cables.—The *Halifax* (Nova Scotia) *Morning Chronicle* in a leader on the "Nerves of the World," states that there are now 13 cables spanning the Atlantic from Europe to America. The new cable from Canso, the fifth to be laid by the Commercial Cable Co., would have been completed this month but for the mishap to the *Colonia*. Now there are 382 cables binding the continents of the world together, and these various lines represent 189,423 nautical miles of cable owned by 35 different nations; 35,129 miles of this belong to various Governments, of which the United States owns but 203, or 1,516 if the Philippines be included. They quote from the *Boston Transcript*: "If the cable has exalted the journalist it has dethroned the diplomat. When he was dependent on couriers or ships for communication with his monarch, when the time for decision on important demands of an adversary, triumphant in war and clamorous for territory, was short, . . . then the plenipotentiaries of the sovereign Powers of Europe had official dimensions which they cannot attain unto now. Nerves of wire bind Portsmouth to Tokio and St. Petersburg in such a way that the hand of Witte must confer with the brain of the Czar, and Komura's feet dare not tread a step without signalling to the soul of Japan incarnate in the Mikado."

Venezuela.—In consequence of the judgement of the Federal Court delivered on August 4th, confirming the dissolution of the contract with the French Cable Co., the Government has ordered the company to close all its stations on the coast. The cable can now be worked only between La Guayra and New York. Communication with the interior will be maintained by the National Telegraph at the rate of one bolivar a word.

CONTRACTS OPEN AND CLOSED.

OPEN.

Austria.—The municipal authorities of Feldkirch are about to invite tenders for the establishment of a central electric lighting station in the town.

Bishop Stortford.—September 26th. The U.D.C. is inviting tenders for lighting such of the public streets as are at present lighted, for two or three years from September 30th, 1905. Thomas Swatheridge, Clerk of the Council.

Burton-upon-Trent.—September 25th. Feeder cables, conduits, &c., for the Corporation tramways. See "Official Notices" to-day.

Dublin.—September 18th. Sub-station switchboards, transformers and mains for the Corporation. See "Official Notices" to-day.

Ipswich.—September 14th. Crompton dynamo and motor, also a battery booster, and switchboard alterations, for the Guardians. Mr. E. McGregor Duncan, Consulting Engineer, 27, Old Queen Street, Westminster. Specifications from Mr. R. J. Kent, Clerk to the Guardians, 19, Tower Street, Ipswich.

London.—September 29th. Thirty-four tramcar bodies, trucks, equipments, &c., for the L.C.C. See "Official Notices" September 1st.

Mussoorie (India).—October 23rd. Supply and erection of steel power pipes, water motors, alternators with exciters, switchboards complete, transformers, induction motors, pumps, workshop machines; also bare copper overhead mains, insulators, and lightning arresters, arc and incandescent lamps, telephone equipment, workshop tools and general stores. See "Official Notices" July 14th.

Oban.—September 11th. Feeders and distributing mains for the T.C. See "Official Notices" September 1st.

Pembroke.—September 22nd. Mains, arc lamps and pillars, meters and switchboard panels, for the U.D.C. See "Official Notices" August 25th.

Pontypridd.—September 30th. Cables and overhead equipment for U.D.C. tramways. See "Official Notices" to-day.

Roumania.—Tenders are invited for a concession for lighting the town of Tulcea by electricity. Tenders are to be delivered within two months (*Curierul Financier*, dated August 6th), and full information may be obtained from the authorities of the town. The upset price is fixed at 500,000 francs.

Salford.—September 14th. Electric wiring of the new Council Schools. See "Official Notices" September 1st.

Spain.—September 15th. The municipal authorities of Plasencia (province of Caceres) are inviting tenders until the 15th inst. for the concession for the electric lighting of the town during a period of 12 years. Tenders are to be sent to El Secretario del Ayuntamiento de Plasencia (Caceres), whence particulars may be obtained.

Spain.—October 14th. The Spanish Ministry of Public Works in Madrid is inviting tenders until October 14th for the concession for the construction and working of an electric tramway in Saragossa. Particulars may be obtained from, and tenders are to be sent to, El Ministerie de Obras Publicas, Madrid.

Stockport.—September 14th. Electric lighting cables for the electricity department. See "Official Notices" September 1st.

Uphall and Broxburn.—September 18th. The District Lighting Committee of the Parish Council invites tenders for an 80-B.H.P. suction gas producer plant, 80-B.H.P. gas engine, 52-KW. dynamo, reversing booster, batteries, switchboard, cables, meters, &c., for extension of its installation. Specifications, &c., from Mr. A. Lindsay, 11, Jamaica Street, Glasgow (deposit £1 1s.).

Watford.—September 18th. Steel chimney for the electricity department. See "Official Notices" September 1st.

CLOSED.

Brighton.—The Corporation Lighting Committee has accepted the tender of the Transporter Co., Ltd., of London, for the supply (and maintenance for a year) of a coal-handling equipment for the Southwick Power Station, at £2,321.

Brush Contracts.—The following contracts have just been booked by the Brush Electrical Engineering Co:—

Two 500-kw. three-phase transformers for the North Metropolitan E.P.S. Co.

Six 60-kw. air-cooled transformers for the Midland Electric Corporation for Power Distribution.

Dartford.—The U.D.C. has accepted the tender of Messrs. Babcock & Wilcox for the supply of a Baker oil separator for the electricity works, at £190, and that of Messrs. J. G. White and Co., Ltd., to lay 90 crossings under the tramway track, at £93 16s. 3d.

Egypt.—The Corporation of Western Egypt has accepted the tender of Messrs. Dick, Kerr & Co., Ltd., for the supply of rails, sleepers, and other permanent way material, in connection with the construction of the Nile Khargeh Railway.

France.—The French Post and Telegraph authorities have just given out contracts for the supply of copper wire, insulated with gutta-percha and parafined cotton, as follows:—La Compagnie Générale de Constructions Electriques, Paris, 20 kilometres single-conductor cable, at 118 fr. per kilometre, and 100 kilometres twin-conductor ditto, at 240 fr. per kilometre; M. Grammont, of Pont de Cheruy (Isere), 200 kilometres of twin-conductor cable, at 238 fr., and 100 kilometres of triple-conductor cable, at 368 fr.; La Societe Industrielle des Telephones, Paris, 200 kilometres of twin-conductor cable, at 229 fr.

Fulham.—The B.C. has accepted the following tenders for the supply and delivery of steam coal to the electricity department:—

2,000 tons Albert Nuts, Messrs. Charrington, Sells, Dale & Co., Ltd., 11s. 11d. per ton.
1,000 tons Crynant Nuts, the Crynant Colliery Co., Ltd., 14s. 4d. per ton.
1,000 tons Monmouthshire Washed Beans, Messrs. Cory Bros. & Co., Ltd., 14s. 1d. per ton.

Imperial Chinese Railway, Pekin.—The tender of Messrs. Bruce Peebles & Co., Ltd., has been accepted for 1,500 h.p. of electrical plant for the complete equipment of the railway shops of the Imperial Chinese Railway, Pekin.

Kirkburton.—The Joint Hospital Committee has accepted the tender of Mr. T. W. Broadbent, of Huddersfield, for the provision of telephones and electric bells.

Luton.—The tender of Triumph Stoker, Ltd., has been accepted for mechanical stokers for the Corporation electricity works.

Neath.—The R.D.C. has accepted the tender of Messrs. Johnson & Phillips for L.T. cables, and street lighting for the districts of Skewen, Melincrythan, Cadoxton and Aberdulais.

North Wales.—The contract for supplying motors for the Oakeley Quarries, North Wales, for 2,000 h.p., ranging from 25 to 125 h.p., for hauling, compressing, winding, &c., has been secured by Messrs. Bruce Peebles & Co., Ltd. The power is to be taken from the North Wales Power and Traction Co's mains.

North-Western Railway, India.—A contract has been placed with Messrs. Ransome & Rapier, of Ipswich, for four 40-ton electric travelling cranes of 50-ft. span, with electrical equipments by the B.T.H. Co., of Rugby.

Shrewsbury.—The T.C. has accepted the tender of Belliss & Morcom for the supply of a new engine to the electricity works.

South Shields.—The Corporation Tramways Committee has accepted the tender of Mr. J. L. Miller for the erection of tramcar sheds, at £9,325 9s.

Warrington.—The County Borough has accepted the tender of Messrs. Johnson & Phillips for 12 months' supply of paper-insulated lead-covered cables.

Windermere.—The U.D.C. has accepted the tender of the Windermere and District Electricity Supply Co. for electric lamp-heads and posts, at 45s. each.

Kettering Electricity Works.—The members of the Midland District of the Incorporated Association of Municipal and County Engineers held their annual meeting at Kettering on Saturday. Mr. T. Reader Smith also read a paper on the "Electric Light and Power Station and Refuse Destructor at Kettering." Mr. F. J. Bakewell, Assoc.M.Inst.C.E., who recently resigned the position of borough electrical engineer under circumstances with which our readers are familiar, followed with a description of the "Kettering Combined Electricity Works and Refuse Destructor."

NOTES.

The British Association Meetings in South Africa.—Electric Power Distribution for the Rand.—Reuter's agent reports (the *Times*) that on August 30th the engineering section devoted the morning to the problem of harnessing Victoria Falls. The discussion was opened by a paper read by Mr. Robert Hammond on "Electric Power Distribution for the Rand." Prof. Ayrton's lecture of the previous night was discussed, together with Mr. Hammond's paper. Prof. Ayrton, after a series of interesting and elaborate experiments illustrating the distribution of power, said that the pioneering development which American enterprise had brought about, combined with the extraordinary commercial success which electric power distribution had won on both sides of the Atlantic, made people ask, "Is such an industrial revolution in store for South Africa?" At first sight the answer was "No," in view of the fact that coalfields blackened the map, and the produce of some was reported to be nearly equal to the best Welsh. On the other hand, he pointed to the experience of South Wales and Tyneside, where electric power was now largely utilised. Considering the possibilities of Victoria Falls, and contrasting them with Niagara, he stated that the water which was utilised, and which would ultimately cease to pass over Niagara, would be nearly five times as large as the total amount passing over the Victoria Falls at the present time. A convenient spot for a power station was at the end of the second gorge, but he advised them jealously to guard the beauty of the Falls. While he advocated the electric transmission of power, he thought they should not start by constructing a transmission line from the Falls to Johannesburg, not because it was unworkable, but because there was not yet sufficient demand for power along the route.

Mr. Hammond, in his paper, said that there were no engineering difficulties in the way of supplying electrical energy to all the mines on the Rand from a central power house utilising the Victoria Falls, but the yearly cost would far outweigh the annual outlay on coal. He sketched in detail a more economical scheme for distributing power by burning coal nearer the Rand. He estimated that they would be able to supply energy at the rate of 0·7d., and he had little doubt that those now using steam power alone, would find it economical to adopt electric power.

The debate, says the report from which we quote, was generally in favour of this view, Mr. Alexander Siemens, however, contending that they could get their electricity as cheap as any central station could supply it. Colonel Sir Colin Scott Moncrieff, president of the section, in thanking Mr. Hammond for his paper, said he shared the hope expressed by one of the speakers that this discussion would bear fruit long after the Association had left South Africa.

Wireless Telegraphy.—On the previous day the Section listened to a lecture by Sir W. H. Preece on this subject. A summary reported through the same agency says that Sir William traced the inception of wireless telegraphy and its development in Great Britain and other countries. He mentioned that the War Office had been making experiments with the different systems. The lamentable failures in South Africa and Somaliland were probably due to the dryness of the earth. Experiments in Wales had proved that mountains were not serious obstacles to wireless telegraphy, and experiments in America had shown that the most serious obstacles were living trees and tropical vegetation. The sea was the natural domain of wireless telegraphy, which for war purposes was imperative, whatever the cost might be.

On the Veld. — The following interesting account of the doings of a party of electrical men at Kimberley is also given by Reuter:—"The last party of trekkers came in at 3 o'clock this afternoon, unwashed and travelled-stained, but full of enthusiasm for the life of the veld. The party included Prof. Perry and his niece, Miss Stower, Mr. Hammond and daughter, Dr. Waller, Archdeacon Hodgson, Captain Wakefield, Mr. and Mrs. Alexander Siemens, and the lady doctors, Miss Barnard and Miss Hardie, and numbered 21 persons all told. The party camped on Sunday night at Abraham's Kraal, on the banks of the Modder River, sleeping on the open veld in blankets and waterproofs. Next day they lunched at Poplar Grove, and late in the afternoon reached General Cronje's laager ground, which was still strewn with skeletons of horses and *débris* of battle. Having dined, they pushed on, guided across the veld by a Boer farmer who fought in the war."

Qualifications of Italian Engineers.—In a public notice inviting applications for the post of municipal engineer to the city of Busto-Arsizio, at a salary of £125 per annum, it is interesting to note some of the points required of the applicants:—

1. Diploma of Civil Engineer and Architect.
2. Certificate of Italian citizenship.
3. Certificate of immunity from crime.
4. Certificate of good conduct.
5. Certificate of health and robust constitution.
6. Certificate of birth, legally endorsed, showing that the candidate is not more than 40 years of age.
7. Certificate proving two years' previous experience in the profession.

As a comment on this list of qualifications, we should suggest that No. 7 is hardly in proportion to the other excellent points considered necessary in the person of the city engineer.

Birmingham and District Electric Club.—The next general meeting of this club will be held on Saturday, September 9th, at the Colonnade Hotel, New Street, at 7.30 p.m. It will be of a social character.

A Soft Job.—A correspondent sends us the following copy of an advertisement which appeared in the *Newcastle Daily Chronicle* last week:—

"MAN Wanted to manage an Electric Light Installation, attend to cows and be generally useful; wife to milk, large family objected to.—Apply by letter to Box M 20, *Chronicle* Office."

Our readers will kindly make their own comments.

Electric Shock Fatalities.—Whitechapel.—At the London Hospital last week, Mr. Wynne E. Baxter resumed his inquiry concerning the death of John Thomas Evans, aged 37 years, a bricklayer, late of Upcerne Road, Chelsea, who died from shock and severe burns received at the electrical sub-station, Whitechapel, in connection with the Underground Railway, on Friday, 11th ult. Another man was injured at the same time, but was only detained in the hospital for a short time; the foreman, named Tufnell, is still an inmate, and was wheeled into the Court to give evidence, looking very ill.

It appears that on the day in question the men entered the high tension chamber for the purpose of removing some iron floor plates, having previously taken some away two days before. They had lifted a plate from the ground, when, without the slightest warning, there was a loud report, followed by a flash like lightning, and the men were at once enveloped in flames. At the time it happened, Clark, the electrician, and Shaw, the chief operator, were talking together at the station door. In the course of their evidence, they both said they did not see the men go into the high tension chamber, neither had they any right to do so without permission. At the time of the occurrence, half the chamber would be alive and the other half dead. The iron plate must have touched the feeder switch to make the electrical circuit.

Henry Tuppin, the foreman, said he gave the orders for the men to fetch the plate. He was not aware that it was necessary to obtain permission to enter the room, neither was he aware of any special danger. He had never received any special instructions, and knew nothing about electricity.

John When, a carman, said he had never been told not to go into the high tension chamber. He had gone into high tension chambers at other sub-stations scores of times and removed plates.

The Coroner: You have always been lucky in picking up dead ones, I suppose.

A representative of the company said if the feeder was not touched it would be impossible to get a shock.

Henry Clements, another employé, said he had never been warned not to go into the high tension chamber without permission. The door was not kept locked; there were no printed regulations to that effect.

After further evidence the Coroner, in summing up, remarked that it certainly was not right that men should be allowed to go into a place surrounded with all manner of dangers. The whole thing seemed to be carried on with great carelessness, and there were not sufficient precautions taken to prevent accidents. He thought the high tension chamber ought to be kept locked, and notices posted at the entrance of the station warning people of the danger. It was a new system of working, and no doubt better precautions would be taken in the future.

The jury expressed concurrence with the Coroner's observations, and added that there had been negligence in the matter. In returning a verdict of "Accidental Death," they added that sufficient care had not been taken to prevent the men entering the chamber, and they desired the Coroner to draw the attention of the directors to the matter in order to prevent similar accidents.

Hastings.—At Hastings, on August 31st, the inquest was held into the death of James Sidney Dixon, which occurred at the power station of the Hastings Tramways Co. His brother, a colliery manager of Bolton, said that deceased was aged 21 years, and had been with Messrs. Dick, Kerr & Co., Ltd., for about four years. A labourer, F. W. Benham, gave evidence to the effect that he had been working on the switchboard erection under deceased's supervision for nine weeks. The switchboard was in the gallery at the top of the building. On August 28th he was in the high tension chamber receiving instructions from the deceased as to some work to be done on the following morning. The work was the tapering of the ends of the cables, and, so far as witness was aware, these cables had never been used. Witness knew that there were "live" wires not far from where they were standing. The high tension chamber, which was on the floor below, was always kept locked, and the keys were hung on the switchboard. Witness took the keys down and deceased unlocked the chamber. They stood about a yard away from the cables, both facing them. Deceased was nearer to them than witness, and was pointing with his left index finger, directing him as to what to do. All of a sudden witness noticed that his hand, pointing to the cables, was a mass of flames. The finger was about an inch away from the cable, and he could not say whether deceased touched the switch (which was at the end of the cable) or the cable itself. When he saw the hand in flames the finger was in actual contact with something between the cable and the switch. He seized deceased and pulled him away, taking hold of his right hand and his clothes. He eased him gently to the floor, and ran for Mr. Hall, and between them deceased was taken outside. Artificial respiration was tried by several people present, but without effect. Deceased did not speak, and only gave a slight cry when the contact took place. Witness could not say whether Dixon was alive or dead when he pulled him off. The switch and cable would be between 5 and 6 ft. from the ground. The reason the high tension chamber was kept locked was because of the danger, and only skilled people were ever allowed in it. Witness added that as he pulled the deceased away he experienced a slight shock, and he had been unwell since.

Mr. Frank Stewart Hall, an electrical engineer, employed by Messrs. Dick, Kerr & Co., said deceased was employed as assistant under him in the erection of the switchboard and other machinery. It was the duty of the deceased to see that work on the cables, as mentioned by the last witness, was done. None of the machinery below the switch had ever been used, as it was erected for No. 2 sub-station, which was not yet built. The "contact" from the floor would be quite 6 ft., and to touch the switch deceased must have reached up. There should not have been any current running through either switch or cable until the new works were erected. Witness had left the chamber about two minutes when the last witness rushed out and said, "Mr. Dixon has had a shock." Witness returned to the chamber and saw him lying face downwards on the floor, about a foot from the side. After dragging him out, artificial respiration was resorted to, but Dixon was dead. Mr. Atkins was called and gave an injection, but to no avail. When deceased was pulled from the chamber he noticed a mark on the face, and it was possible that the current passed through the arm, shoulder and neck, and out at the chin. Witness thought the deceased took hold of the switch, knowing it was perfectly safe, and, while turning to see if Benham was attending to what was being said, accidentally touched the top contact, causing the current to pass from the bus-bar into him. Deceased was sober, steady, and highly trusted by his superiors.

By a Juryman: After the accident an examination of the switch proved that it had been moved, and it was also bent.

Mr. Edward James Atkins, medical practitioner, of Elphinstone Road, deposed to being called to the power station, where he found the deceased lying on the floor of the gallery. After an examination, the artificial respiration was kept up and an injection given. Deceased was apparently dead when witness arrived. Deceased died as the result of an electric shock.

In summing up, the Deputy-Coroner tendered, on behalf of himself and the jury, the sympathy of all. He thought the theory Mr. Hall had formed was correct. The deceased, without thinking, caused a circuit inadvertently.

A verdict of "Death from Misadventure" was returned.

Fatal Accidents.—On Tuesday evening a visitor who was being shown over the Lots Road Power Station by some means missed his footing and fell a distance of some 50 ft. to the bottom of an empty coal bunker. Some difficulty was experienced in reaching him in the darkness, and he expired almost immediately. An inquest will be held shortly. It may be remarked that many thousands of visitors have inspected this station, so far without accident.

On August 29th an engineer's fitter, named Frederick Meaker, met his death by falling down the shaft of the new tube station at Upper Baker Street, a distance of 70 ft.

Frederick J. Skelley, an electrician employed at the Alhambra, was riding in the trailer of a motor cycle on Thursday last week when the shaft of a cab, coming from the opposite direction, struck him in the face and flung him into the road. He was dead when picked up.

An inquest was opened on Saturday at the Newcastle Tramways power station, Manors, on the body of John Henry Adams, 22 years of age, an electrician, who died as the result of a lift accident at the power station building.—Ernest Adams, of Heaton, identified the body as that of his brother. On the Friday evening his brother got fastened between the lift and the wall of the well on the third storey. The wall was hacked away to release him. Dr. Hawthorn, who was called, pronounced life to be extinct. The inquest was adjourned until Thursday (yesterday) for the attendance of the Factory Inspector. The deceased was complimented not long ago for the efforts he made to rescue a child from drowning in Byker Hill Quarry.

Appointments Vacant.—The electrical engineer at Port Elizabeth recently intimated that he would require the services of a chief assistant, a wiring inspector, a qualified fitter and erector and three jointers. It was resolved that applications for post of chief assistant be advertised both in South Africa and in England; the Portsmouth Higher Education Committee have recommended the appointment of a head of the physics and electrical engineering department at a salary of £175 per annum. Hitherto, says an educational contemporary, there has been only an occasional staff; two assistants are wanted in the engineering department at the University of Glasgow; two junior engineers for Erith electricity department (£1 10s.); and a cable jointer for Lancaster (35s.).

Standardisation in Italy.—In *l'Elettricita* for July 28th, a long communication from an engineer is given relative to the necessity of establishing, by order of the State, a standard frequency for all alternating current systems of electricity supply. An analogy with railway working is taken as an indication of the advantage to be derived from interchange of traffic and supply. Moreover, the Italians are looking forward to the time when all the railways in the country will be worked electrically, and this could be more easily secured by maintaining similarity in the generating works. The editor in dealing with the matter admits the great importance of the problem, but thinks that matters of such a technical character are best dealt with when unhampered by Government regulations.

Trials of Electrical Vehicles in France.—La Compagnie Parisienne des Voitures Electriques, of Paris, last week submitted two of their Krieger electrical carriages—a two-seated and a four-seated *coupé*—to a long-distance test. In the Krieger system two electric motors are employed, these driving the front road wheels through spur gearing. The two-seated vehicle was fitted with a battery of 42 accumulators and the four-seated with

44 cells, both supplied by La Société Electrique des Métaux. The smaller carriage weighed complete 1,900 kilogs (37 cwt. 36 lb.), and the larger one 2,090 kilogs (2 tons 108 lb.). The two-seater left Paris at 5 a.m. on the 31st ult., Evreux at 7.53 a.m. Here the batteries were re-charged, a re-start being made at 11.4 a.m. Deauville, 191 kilometres (120 miles) was safely reached at 1.23 p.m. The net running time from St. Germain was 4 hours 10 m. 14 sec., and the average speed 28 miles per hour. The four-seated carriage left Paris at 5.5 a.m., and arrived at Deauville at 1.34 p.m., after a stop of 2 hours 7 min. at Evreux for battery re-charging purposes. Its net time from St. Germain was 4 h. 22 m. 30 sec., equal to 27 miles per hour. On arrival at Deauville the two cars were subjected to a speed trial over a level stretch of 500 metres ($\frac{5}{16}$ths of a mile), the light car covering this in 29⅘ sec., equal to 38 miles per hour, and the heavier one in 30⅕ sec. (37½ m.p.h.) The return journey from Deauville to Paris was made on Friday, the 1st inst., when the whole distance was covered by both vehicles on one charge of the battery, no stop being made *en route* for re-charging purposes. The official times taken were those for the run from Deauville to St. Germain, that of the two-seater being 5 h. 14 m. (22 miles per hour), and of the four-seater 4 hours 55 min. (23 miles per hour).

Electric Traction on Australian Railways.—The paper on "Electric Traction on Railways by Alternating Currents," which was read before the Electrical Association of New South Wales in June by Mr. E. Kilburn Scott, of the Sydney University, was discussed on July 14th. Mr. T. Rooke (city electrical engineer), Sydney, occupied the chair, as President of the Association.

Mr. O. W. Brain, electrical engineer for railways, opened the discussion. He said that the multitude of electrical systems, all more or less successful, lent an air of uncertainty to the outlook, but in view of the great advances in alternate current traction to which Mr. Scott had called attention, and the many recent important improvements in details of equipment, there was every reason to regard optimistically the present promise of unprecedented progress in electric railways in the immediate future. All would agree that the electric system of traction presented the advantages of centralisation of power, high acceleration, frequent trains, &c., but, on the other hand, they should be fair to steam.

Mr. W. Thow, chief mechanical engineer for railways, agreed that most of what Mr. Kilburn Scott claimed for electric traction over the locomotive system must be admitted, even by locomotive men themselves. But the cost of substituting electric traction for steam was a question which had to be considered by all railway managers. It seemed to him that the reason why electric traction had progressed so slowly was simply the enormous expense involved in conversion. The horse-power of the locomotives on the suburban lines was 45,000; while the electric trams of the city had 17,000 horse-power. The whole horse-power for working all the lines of the State was 425,000. An engineer having a clean sheet before him would, he believed, adopt the electric system in preference to steam in nine cases out of ten. There were between 3 and 3½ millions of money invested in locomotive stock and apparatus incidental thereto, in New South Wales. If that had to be set aside, it would be seen how important it was to a young country such as Australia.

Other contributors to the discussion were Messrs. Oswald Haes, Henry Deane, A. W. Kendall, J. R. W. Gardam, Strickland, P. L. Weston, S. H. Barraclough, and Arnot.

The Chairman remarked that while the time might not have arrived to convert or suggest the conversion of all the steam roads into electric roads, yet, he thought, in view of the fact that so much was being done elsewhere, that the Government should consider the question of electric traction for some lines, to ascertain what were its practical possibilities.

In his reply, Mr. Kilburn Scott referred to the locomotive contract recently let to the Baldwin Co. by the Government, and asked what was the use of buying engines that would be out of date in a few years? Why not, he said, spend the money electrifying the North Shore line, or some other line, and send the locomotives thus set free out into the back country? The time must soon come when that would have to be done.—*Sydney Daily Telegraph.*

The Trade of the Philippines.—Clear evidence of the effect of foreign tariffs and influence is seen in the trade of the Philippines. Left to the exercise of their own free choice, the Philippinos dealt largely with the United Kingdom, but since they have been placed under the subjection of America they have been compelled to forgo their freedom and buy from America, and British goods are practically forbidden, though not yet choked off. We do not know if this taxation without representation is in any way resented by the Philippinos, but no word is to hand as to any tea being thrown overboard. It is a long time since 1776.

A New Steel Wheel.—A few weeks ago when describing Messrs. A. Baker & Co.'s exhibit at the Agricultural Hall, we drew especial attention to a novelty in the way of steel forging. It consisted of a wheel centre forged from the solid out of one billet. Hydraulic press forging has indeed increased the scope of the smithy, and it does not stop at making wheel centres only, but turns out the wheel complete and in one piece. A description of the process, as developed and applied by Mr. Chas. T. Schoen, appears in an article on steel wheels in the *Street Railway Journal* for June 17th. "The blanks, as they come from the mill, are nearly square. They are heated and placed beneath the hydraulic forging press, that has a capacity of 4,400 tons. Here the hub is formed, the web just outside of it brought down to an approximate thickness, and the rim afterwards sheared off by a circular punch." After reheating, the wheel in embryo passes to a special rolling mill, where it is subjected to the action of five rolls. "One bears directly against the tread and flange and shapes the same; two bear against the side of the rim and roll it to the proper width, while the last two are forced against the web and the under side of the rim with a pressure of about 250 tons, and, rotating the whole between them, roll the web down to the proper thickness. . . . . This rolling process occupies about three minutes." Still at a bright heat, the wheel is carried to another press, in which the proper disk is given to the web. After this process "there will not be a variation of more than $\frac{1}{32}$ in. in the diameters of wheels of the same nominal size." The physical properties of a wheel thus made are said to be superior to those of steel-tired wheels. We do not gather that the wheel had been put to practical use at the date of the article, but there can be no question of its running when once the vast difficulties of manufacture have been overcome, and that seems to be an accomplished fact. Nothing is said about the comparative cost of the usual tired-wheel and this new one-piece wheel, nor is it stated that tires may be shrunk on after the "natural tire" is worn down, but there ought to be nothing in the way of that being done.

We have a suspicion that something similar, or identical, has been worked out by an English firm of wheel makers, and if that is so, perhaps the firm in question will give us an opportunity of supporting British industries!

Single-Phase Railways.—Two interesting papers upon "Line Construction for Single-Phase Railways" were read on March 24th before the American Institute of Electrical Engineers, and they deal with the line construction suitable for use on a standard steam railroad, when converted to electric traction, where a serviceable system is required reliable for several thousand volts, and equal in durability and cost of maintenance to the bridges, track, and other portions of the standard steam road, making due allowance for somewhat less expensive construction on the lighter interurban sections.

For bracket-arm construction, the arm is a T-iron supported by a tension rod at its outer end, and fitted at the inner end with lugs screwed to the pole. The corrugated porcelain insulator, mounted on a sleeve on the T-iron, is protected by guard loops from a derailed trolley, and the steel supporting cable, or messenger, is slung from a clamp round the insulator; the hangers from messenger to trolley wire are spaced 10 ft. apart, are stiff, and are of such a length as to keep the trolley wire horizontal, ensuring freedom from twisting, but have just sufficient flexibility to allow small vibrations to pass on, and to entirely obviate the tendency in rigidly supported spans for waves to be reflected from these fixed points with the usual flashing as the wire is lifted from the trolley. It is recommended that the spans be 120 ft. on a straight track, the galvanised steel messenger cable being strained to a tension of 2,000 lb., and having an ultimate strength of 6,000, with 000 grooved section trolley wire. For four-track roads, the most permanent type of construction is that of the signal bridge type spanning the track, carrying the semaphores, cables, trolley wires and feeders, and placed for straight tracks 300 ft. apart. It does not follow that semaphores will be fitted to all these bridges, and those without semaphores can be of lighter construction, as also the bridges in places where the railway land permits of guy cables. A test of the insulation made under snowclad conditions for 2,500 ft. of iron-bridge work, and five miles of single catenary construction, gave a leakage of 1 ampere at 6,000 volts.

In the discussion following the reading of the paper, it was generally agreed that for interurban electric lines the conductor pressure should be from 3,000 to 6,000 volts; for the electrification of steam roads the pressure could be from 6,000 to 15,000 volts, and for collection of current a bow collector for interurban work, and a contact arm for steam road installations, would allow the location of the contact wire to be standardised.

Water-Power in Austria.—Since the commencement of the construction of the new railways in the Austrian Alps, the question of introducing electric locomotion instead of steam for working the lines has received consideration. The State Railway Authorities have now referred to the districts of Hallein and St. Johann for examination, a scheme which aims at the utilisation of the water-power of the Salzach between the Concordiahutte and Golling on the Salzburg-Innsbruck State line. It is estimated that by damming the river and installing turbo-generators, it would be possible to obtain 6,300 kilowatts at the lowest level of the river, and this power could be used for operating one or more of the Alpine railways, as, for instance, the Tauern line and the Karewanken line.

The Electro-Technical Association of Italy.—The following is a list of papers recently contributed at the various centres of the Association:—"Electric Traction with Monophase Motors," by Engineer U. Segre, Naples; "The Monophase Motor in the United States," by E. Solieri, Turin; "Considerations of Electrical Measuring Instruments," by V. Arcioni, Milan; "The Osmium Lamp as a Standard of Light," by G. Revessi, Rome; "Some Considerations on the Projected Hydro-Electric Installation of the Municipality of Turin," by E. Silvano, Turin; "The Osmium Lamp in Relation to Modern Theories of Radiance," by G. Revessi, Rome; "The Modern Incandescent Lamp," by Prof. P. Montu, Naples; "Considerations on Conductors Forming Parts of Coherers," by U. Crudeli, Rome. There is so much sound and substantial matter in the papers comprised in the above list that it is a matter for regret that they cannot be translated *en bloc*, and republished in our own language—or, put in other words, we are still suffering for the misdeeds of our forefathers in connection with the construction of the Tower of Babel.

The subject of the first paper, "Electric Traction with Mono-

phase Motors," is one of the most, if not the most, important problem to-day awaiting a complete solution; that it is being solved there is ample evidence. The author considers that the problem has not been attacked so heartily in Europe as it should have been, on account of the success that has been achieved with polyphase motors for traction purposes. He points out, however, that the polyphase motor must of necessity be practically a constant-speed motor, and again, that at least two, if not three, overhead conductors become necessary, with their numerous supports and more complicated connections. The single-phase series motor is therefore eagerly sought after, and amongst those diligent in the search is mentioned Dr. Finzi, of Milan. The induction motor is condemned for traction purposes owing to its weak starting effort. To construct a single-phase compensated series motor it is necessary to carefully balance the number of turns on the exciting magnet and on the armature, making the latter comparatively strong; but if certain limits are passed, the reaction and self-induction of the armature increase and outweigh the diminished action of the magnets. To avoid this, the only way is to compensate the reaction of the magnets by a stationary coil round the magnets, which is energised by being coupled in series with the armature, or by being closed upon itself when an induced current is produced. Various questions are then dealt with as to the security of working, the weight per horse-power, the necessary space required, the starting losses, regulating facilities, and other matters. In concluding, the author contends that the commercial single-phase series motor and its system of regulation are no longer matters of conjecture; he points out that the generating stations supplying such motors must be well provided with plant, as it will not be possible to use accumulators from which to draw at times of exceptional load.

Both papers written by G. Revessi, of Rome, and read before that section of the Association on the subject of "Osmium Lamps," are of a highly technical nature; the conclusions are drawn from a series of experiments conducted at the Royal School for Engineers at Rome with instruments lent by the President of the Association, Prof. Ascoli. The summary of the qualifications of the osmium lamp is given in the following terms:—The possibility of obtaining material of the highest quality and the very high temperatures at which this can be worked contribute to the superiority of the osmium lamp over the carbon filament lamp; the fact that the luminous value of the lamp remains constant, and likewise the current that it consumes, are points in its favour, whilst the whiteness of the light, owing to the elevated temperature, makes it more beautiful. The osmium lamp may not be the final step in incandescent illumination, but theory indicates that it is a long step in the right direction.

The paper contributed by Mr. Silvano concerning the hydro-electric installation projected by the municipality of Turin is an open criticism on the estimates and general character of the proposed work. In reading the paper one inclines to the idea that the author has had a toe trodden on by the enterprise of the local authority, but towards the end of the paper it is clearly stated that he has no interest whatever in putting forward his ideas beyond that of a practical engineer desiring to see public mistakes avoided. In all cases, however, of projected installations, very many matters must be decided on the opinion of some engineer, and it is at almost every matter of opinion that the Turin adviser has given that Mr. Silvano aims his criticisms. The generating works are to be established at Chiomonte, a distance of 60 km. from the city, and the estimates for hydraulic works and buildings amount to about £106,000, machinery £50,000, lines £36,000, preliminary expenses £12,000, contingencies £3,600; these figures total to £207,600, against which Mr. Silvano shows reason to anticipate a cost of at least £250,000. The cable network and sub-stations in the city are estimated to cost a further sum of £127,000; included in this is an item of £41,000 to be spent on an overhead distribution line working at 200 volts three-phase. The author remarks that there are already five other systems working in various parts of the city, all at different voltages, and of continuous, single, and three-phase varieties. "What a delightful state of affairs for the private consumers, the manufacturers, the installation firms and the vendors of machinery!"

The Conductivity of Coherers.—The operation of coherers consists mainly in rays of electrical energy striking loose metal powder and rendering this conductive of electric currents as long as no other influence annihilates this temporary conductivity. The mechanism of this process is far from being elucidated, and as a contribution to the knowledge of coherers, Mr. R. Thöldte (in the *Annalen der Physik*, No. 9, 1905) suggests ascertaining whether below the critical potential difference (the minimum potential difference required for the occurrence of the coherer effect), the resistance of the coherer can be reduced by other means, *e.g.*, by an increased ionisation. Experiments made by the author show the resistance of the coherer to be really decreased under the influence of radium by appreciable amounts even below the critical potential. The conductivity of a coherer produced by short-circuiting is found to be considerably increased under the influence of radium. From the above it is inferred that the conductivity of coherers depends on two factors, viz., electrical vibrations and ionisation.

The Water Ozonising Plant at Bréda.—A description has been recently published of the plant which has been erected at Ginneken for the purification by means of ozone of the water supplied to the town of Bréda in North Brabant, Holland. The crude water is taken from the river Mark, and is of very irregular composition. It has a yellowish brown colour, and contains much organic matter, decomposing from 20 to 32 milligrammes of permanganate per litre. Bacterially the water is bad, yielding on an average 6,000 colonies per cc. after two days of culture. The river passes through a highly manured and cultivated country, and receives much surface water as well as many drainage dykes before it arrives at the intake, and so the supply is liable to contain pathogenic micro-organisms. The whole of the power required to filter, raise, ozonise, and distribute the purified water is taken from the central station which supplies the district round Bréda with electric light and energy; where the dynamos, partly giving direct current, and partly alternating, are driven by gas engines fed with anthracite gas from Stockport producers. After filtration through gravel and sand, the water is raised to a tank holding about 7,000 cb. ft., which is supported by a masonry tower 97 ft. high. The total power consumed in the waterworks is 15 KW. for a supply of 4,500 gallons per hour, 9·5 KW. being direct current, and 5·5 alternating current. In case of fire, however, the supply can be increased to 13,000 gallons per hour at a pressure of 2·5 atmospheres. There are 12 ozonisers of the Schneller type, with glycerin resistances, 10 being usually in action at one time. They absorb on an average 500 watts each. From a report signed by M. Léon Gerard, it appears that the treatment with ozone destroys nearly all the bacteria in the water, and is much more efficient than any system of sand filtration. The latter usually leaves 150 colonies per cc.; but 50 per cent. of the ozonised samples were found sterile at the end of three days, and 20 per cent. after six days. *B. coli* always disappears, although the treatment lasts only 40 seconds. The chemical qualities of the water are also improved, as shown by the figures obtained by Dr. Gorter for the water of the Mark before and after purification (milligrammes per litre): permanganate destroyed (before) 30·8, (after) 16·5; free ammonia 0·190, 0·025; albuminoid ammonia, 0·23, 0·20; total solids 174, 170; organic solids 52, 44. The amount of chlorine (16·5) remains virtually unaltered. It is said that the entire treatment removes 43·5 per cent. of the organic matter in suspension in the water, 9 per cent. being removed by the ozone alone. The purified water is fully aerated, has a pleasant fresh taste, and contains no ozone or foreign matter; its colour is perfect. Under the conditions that obtain at Bréda the cost of the whole operation is about 5 centimes per cubic metre, of which 1·17 centime represents the ozone employed; the former figure includes all the direct expenses, as well as interest on the money sunk and depreciation on the plant.

Protection in America.—American manufacturers appear to us to be extremely inconsistent in railing at their Custom House and its ways. Uncle Sam's Customs officers lie in wait for foreign material and mulct somebody in about half the value or more of the article. When, however, such an article happens to be a piece of turned rod sent from Scotland to be finished as a sample of what a certain tool will perform, the man who has to pay the duty on the sample piece writes wrathfully to the *American Machinist* to complain. Now the American tool-makers have been in the past among the most powerful upholders of a high tariff upon British-made goods, and it is hardly fair that after so many years of their Customs officers' assistance in a million cases there should be such a hubbub over a paltry bit of turned bar. Americans have required many years to find out what is now described as the foolishness of their Custom House, and there are no such grumblers and squirmers as Americans at the small matters of which our Customs officers must take note—chiefly, we believe, pirated editions of English authors, whom the American public refuses to acknowledge as entitled to any reward for the authorship of the books they read. Americans are anxious to do a foreign trade, but they still lack the understanding which would show them that though trade is carried on upon a basis of referring all goods to a single standard of cash, there is little or no cash really passing to and fro. Cash does pass to and fro in small quantities, but only to the extent that electricity passes to and fro through a balancer between the two sides of a distribution system. The Americans think that by tariffs they can take up a constant flow one way through the equaliser of trade balances. They cannot.

Metallic Peroxides.—Peroxides of various metals are among the recent interesting productions of electro-chemistry. Sodium peroxide is now being put on the American market in a fused condition, in which form it is stated to be much more permanent in air than earlier specimens were. Under the name of "oxone," it is sold in rectangular blocks weighing 70 grammes each. When brought into contact with water it evolves oxygen, just as calcium carbide evolves acetylene in similar circumstances, the gas-making power of oxone being 59 litres of pure oxygen per pound. It is employed by optical lantern operators, and also, we believe, for the production of the oxygen which is required in certain types of the oxy-acetylene blowpipe. Experiments have also been carried out upon the manufacture of a calcium peroxide of 60 or 65 per cent. purity. This substance is insoluble in water, but evolves oxygen on heating or in contact with moist organic matter. It is therefore proposed to use the peroxide in the sterilisation and preservation of articles of food, for the "treatment" of wine and spirit, and for various therapeutic objects. A magnesium peroxide of 25 to 32 per cent. purity can be employed for the same purposes. According to Dr. Von Foregger, a tablet containing 0·1 gramme of magnesium peroxide and 0·5 gramme of citric acid dissolves easily in 1 litre of water, sterilising the liquid completely in two minutes. A 50 to 60 per cent. zinc peroxide may be employed in the preparation of antiseptic surgical dressings. Although not itself a peroxide, sodium perborate, which contains 100 per cent. of $NaBO_3 + 4H_2O$, may be dissolved in water so as to obtain a "50-volume" solution of hydrogen peroxide; and the latter is exceptionally useful for bleaching purposes. Electrical ozone is also being used in the form of ozonised air to oxidise isoeugenol in the manufacture of vanillin from oil of cloves.

OUR PERSONAL COLUMN.

[*The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the* Electrical Review *posted as to their movements.*]

Central Station Engineers.—Mr. S. Gibson, station fitter at Oban Electricity Works, and Messrs. G. F. Gregory and C. F. Reeve, both shift engineers under the Northampton Electric Light and Power Co., have been appointed senior and junior shift engineers at the Cambuslang electricity works of the Lanark County Council. There were 134 applicants for the former position, and 189 for the latter post, making a total of 323 candidates.

At a recent meeting of the East London T.C., it was decided to award a special bonus of £50 to Mr. Prescot Adkins, of the Town Electrical Engineer's Office, for extraordinary services performed during the absence from duty of the town electrical engineer through illness.

Mr. Ralph Lomax, of the Stockport Corporation Electricity Works staff, was married at Darwen last week, to Miss Margaret Hodgson, daughter of Mr. J. E. Hodgson, of Darwen.

Dundee Tramway Committee has lately been called upon to define the exact positions occupied by Mr. H. Richardson, the city electrical engineer, and Mr. Peter Fisher, the tramways manager, in relation to one another. The former gentleman claimed the title electrical and tramway engineer, but, in reply, Mr. Fisher made a statement showing the part he had been called upon to fill in connection with the design and equipment of the cars. In the end the Committee resolved that Mr. Richardson should be designated "consulting tramway engineer" in addition to being styled electrical engineer.

Mr. Pakenham W. Beatty, who has been acting for the past eight months as temporary assistant to Mr. Herbert W. Bush, resident engineer and manager to the Urban Electric Supply Co., Ltd., Newbury, is leaving Messrs. Edmundsons to take up a position with the London Underground Electric Railways Co. Mr. Beatty has been with Messrs. Edmundsons for some five years at Woolwich, Glossop and Newbury.

The Electric Lighting Committee of Bermondsey reported at the Council meeting on Tuesday having appointed, during the vacation, Mr. A. R. Gundry, engineer-in-charge at St. Pancras, to be third engineer-in-charge. Mr. Gundry had taken up his duties.

The Johannesburg Council has now confirmed the appointment (mentioned in our last issue) of Mr. J. F. I. Thomas, as general manager of the Lighting and Tramways undertaking.

Tramway Officials.—The Tramway Committee of the South Shields T.C. on Monday decided to recommend the Corporation to amalgamate the offices of tramway manager and electrical engineer, and to offer the post to the present electrical engineer (Mr. J. H. Cawthra), his salary to remain as at present for a year. It was also decided to appoint a traffic manager under Mr. Cawthra.

General.—On Thursday evening, August 31st, Mr. S. L. Brunton, late works manager to Messrs. Crompton & Co., Ltd., was presented with a silver tea and coffee service by the staff and employés at the Arc Works, Chelmsford. The presentation took place in the men's recreation room, and a very large number of the staff and workmen were present. In the absence of Mr. W. A. Price, the works manager, Mr. A. J. Hodgson, manager of the arc lamp and switch department, made a brief speech, in the course of which he said that Mr. Brunton had held the position of works manager for a considerable number of years, and during that time had seen many changes. He had held the reins through very trying times—in fact, since he first took charge, the whole electrical world had been turned upside down. He had got through a tremendous amount of work, including the complete building up of the present Arc Works, which, so long as they stood, would remain a monument to his energy and ability. Through it all he had held the esteem of his staff and employés, and his retirement was universally regretted. Personally, he (Mr. Hodgson) had spent some seven years directly under Mr. Brunton; he owed a great deal to his guidance and help. He could not wish to serve under a kinder or a better chief. On their behalf as well as his own, he wished Mr. Brunton every success in whatever he took in hand, and also long life and happiness both for himself and his family. After a few words from Mr. P. G. Cheverton, Mr. W. Bickmore and Mr. C. Berry, Mr. Hodgson made the presentation.

Mr. S. L. Brunton, who was received with loud cheers, said that a works manager's position, having the directors on one side and the staff and workmen on the other, was not the easiest thing imaginable. He felt that whenever there had been any little difficulty he had been met very loyally by everyone, and the difficulties had never been really serious. So far as his relations with the staff and workmen had gone, he thought he might say that without exception they had been pleasurable. He could only hope that the same feeling would continue with this company and that everyone, whether workmen or members of the staff, would preserve that spirit and be loyal to the management, because on this very largely depended the success of the company, and their own success was bound up with it. Although it was a very great pleasure to him to receive that handsome present, it was a still greater pleasure to have heard the opinions that had been expressed. The best thing he could hope for himself in whatever he might be doing in the future, was that he might have a staff and workmen (if he had any workmen) with whom he would be able to preserve such good relations. He concluded by wishing them all every success. He hoped that the work would flourish, and that there would be plenty of it to keep them all employed continually.

At North Shields on 2nd inst., Mr. O. L. Falconar, A.M.I.E.E., senior partner in the firm of Falconar, Cross & Co., of Newcastle-on-Tyne, was married to Elizabeth, daughter of the late John Bell, of North Shields.

Mr. George Edward Wright, A.M.I.E.E., electrical engineer to the North-Western Railway, India, who returned to England on leave early last month, is engaged here in connection with certain electrical plant which is now under supply for his railway.

Mr. Ange Vlachos has been appointed Director-General of Posts and Telegraphs of Greece, *vice* Mr. N. Lamprinopoulos, deceased.

Dr. J. Erskine Murray, who for many years carried on electrical research work under Lord Kelvin, and who was for some years chief experiment assistant to Mr. Marconi, has commenced business as consulting electrician at 219, St. Vincent Street, Glasgow, his specialities being wireless telegraphs and the design of electrical and physical apparatus.

Obituary.—Mr. F. L. Gascard, the chief secretary of the Bureau International, died on June 19th last, and his office has been filled by Mr. J. C. Homberger, the assistant secretary.

NEW COMPANIES REGISTERED.

Torquay Tramways Construction Syndicate, Ltd. (85,659).—This company was registered on August 24th, with a capital of £140,000 in £1 shares, to adopt an agreement with the Dolter Electric Traction, Ltd., and to carry on the business of railway and tramway proprietors, suppliers of electric light and power, electrical engineers, contractors, metal workers, constructors and layers of cables, wires, and other requisites, manufacturers of rolling stock, &c. The first subscribers (each with one share) are:—F. T. Medcalf, 9, Great St. Helens, E.C., solicitor; J. R. Marriott, Kibworth, Leics., solicitor; T. H. Fidgen, Sefton Cottage, Forty Hill, Enfield, insurance agent; H. St. J. Browne, 12, Gordon Mansions, W.C., gentleman; W. Eacott, 29, Powell Road, Clapton, N.E., gentleman; C. T. Lissenden, 24, Arica Road, Brockley, S.E., gentleman; and P. R. Reeves, 186, Chamberlayne Wood Road, Kensal Rise, N.W., shorthand writer. No initial public issue. The number of directors is not to be less than three nor more than seven; the first are L. B. Schlesinger, H. N. Lubbock and J. T. Jervis; qualification, £100; remuneration, £50 each per annum (chairman £50 extra) with an increase according to profits. Registered office, Queen Anne's Chambers, Westminster, S.W.

Surrey Syndicate, Ltd. (85,669).—This company was registered on August 25th, with a capital of £6,000 in £1 shares, to adopt two agreements, the parties to which are not named, the first being for the acquisition of an invention for improvements in printing telegraph machines, protected by patent No. 15,598 of 1901, and the second for the acquisition of similar improvements protected by a French patent, No. 306,808, and a German patent, No. 134,995, to carry on the business of a telescriptor, velocriptor, telephone and telegraph company, to establish, work, manage, control and regulate electric-recording systems, &c. The first subscribers (each with one share) are:—C. O'Malley, 57, Ladbrooke Grove, W., solicitor; H. Jordan, 121, Hydethorpe Road, Balham, clerk; C. Jones, 36, Claremont Road, Staines, clerk; C. H. Cox, 14, Alperton Street, Queen's Park, W., clerk; W. H. Lewis, 171, Summerhill Road, Dulwich, S.E., clerk; J. H. Lynch, 18, Maitland Park Villas, Haverstock Hill, N.W., surveyor; and W. Liquorish, 21, Westmoreland Street, Pimlico, S.W., serjeant commissionaire. No initial public issue. The subscribers are to appoint the first directors.

Burgess Hill and District Electric Supply Co., Ltd. (85,698).—This company was registered on August 29th, with a capital of £5,000 in £1 shares (2,000 5 per cent. non-cumulative preference), to adopt an agreement with W. Simms, trading as "Simms & Co., electrical engineers," of Hamilton Road, Felixstowe, and to carry on at Burgess Hill, and elsewhere in Sussex, the business of an electric light and power company, and that of electrical and general engineers, electricians, manufacturers of and dealers in all kinds of electrical apparatus and accessories, &c. The first subscribers (each with one share) are:—W. H. de la Tour d'Avergne Findlay, 11, Prospect Place, Burgess Hill, architect; H. Aldrich, St. Margaret's, Burgess Hill, merchant; W. B. Welch, Wolstonbury, Burgess Hill, surgeon; A. G. Davey, Church Road, Burgess Hill, fruiterer; T. Sinnock, Burgess Hill, auctioneer and valuer; D. A. Davies, Church Road Chambers, Burgess Hill, solicitor; and O. S. Jaques, Erin Manor, Burgess Hill. No minimum subscription fixed. The number of directors is not to be less than four nor more than seven; the first are W. H. de la Tour d'Avergne Findlay, H. Aldrich, W. B. Welch and A. G. Davey; qualification, £25; remuneration as fixed by the company. Registered office: Mr. Thomas Sinnock's offices, Railway Approach, Burgess Hill, Sussex.

Volta House, Ltd. (85,706).—This company was registered on August 29th, with a capital of £1,000 in 500 6 per cent. preference shares of £1 each and 2,000 ordinary shares of 5s. each, to carry on the business of electricians, electrical and mechanical engineers, suppliers of electricity, manufacturers of and dealers in electrical apparatus, &c. The first subscribers (each with one preference share) are:—A. F. H. Wray, 39, Berners Street, W., manufacturer; C. A. Andrews, 23, Binfield Road, S.W., medical electrician; R. P. Wray, A.M.I.C.E., 105a, Cheyne Walk, Chelsea, S.W.; H. Townsend, 5, Aboukir Street, Peckham, S.E., electrician; H. Moston, 59, Salgrave Road, Shepherd's Bush, mechanical engineer; C. F. Andrews, 14, Store Street, W.C., bookbinder; and P. Wray, 105a, Cheyne Walk, Chelsea, engineer. No initial public issue. Registered without articles of association. Registered office: Volta House, 175, Wardour Street, W.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Sloan Electrical Co., Ltd. (61,528).—This company's annual return was filed on August 22nd, when 5,000 "A" preference, four "B" preference, and 2,750 ordinary shares had been taken up out of a nominal capital of £15,000 in 5,000 "A" preference, 5,000 "B" preference, and 5,000 ordinary shares of £1 each. £1 per share has been called up on four "B" preference and 1,250 ordinary, and £1,254 has been received. 6,500 shares are considered as fully paid. Mortgages and charges: nil.

Bastian Meter Co., Ltd. (Westminster), (53,304).—Memoranda of satisfaction in full of a charge dated December 30th, 1901, and of debentures dated October 20th, 1904, securing £6,000 and £2,500 respectively, have been filed.

Newcastle and District Electric Lighting Co., Ltd. (28,022).—A trust deed, dated August 8th, 1905, to secure £150,000 debenture stock created by resolution of June 2nd, 1905, has been registered. Property charged: Freehold land and generating stations at the Close, Newcastle-on-Tyne, and at Lemington, leasehold land and generating station at Forth Banks, Newcastle-on-Tyne, any money resulting from compulsory sale under any contract prior to date of trust deed, or under any Provisional Order or Act of Parliament, and the company's general assets, present and future, excluding uncalled capital. Trustees: W. Milburn, 130, Fenchurch Street, E.C.; E. Waterhouse, 3, Frederick's Place, Old Jury, E.C.; and W. Greenwell, 2, Finch Lane, E.C.

Fife Electric Power Co., Ltd. (75,736).—A trust deed, dated August 15th, securing £15,000 debentures created by resolutions of June 6th and August 15th, 1905, has been registered, together with a disposition and an assignation, both of even date, executed in pursuance thereof. Property charged (by trust deed):—The company's general assets, present and future, including uncalled capital; (by disposition) ground and generating station at Townhill, Dunfermline; (by assignation) right to railway siding agreement. Trustees: R. E. Walker, Transylaw, Dunfermline; Lieut.-General Sir Richard H. Sankey, K.C.B., R.E., 82, Grosvenor Place, S.W.; and H. Mungall, 20, Royal Terrace, Edinburgh.

A. J. Harris & Co., Ltd., Electrical Engineers, Bradford (85,118).—Issue on August 16th of £1,000 debentures, part of series created July 19th, 1905, to secure £1,500, charged on the company's undertaking and property, present and future, including uncalled capital. No trustees. No previous issue of same series.

Scottish House-to-House Electricity Co., Ltd. (29,232).—A mortgage or charge for £1,500, dated August 24th, 1905 (supplemental to a lien dated March 31st, 1904), has been registered. Property charged: The Coatbridge and Airdrie undertakings and the company's general undertaking and property, present and future, including uncalled capital. Holders: County of London Electric Supply Co., Ltd.

ELECTRIC TRAMWAY ACCOUNTS.

Glasgow Municipal Tramways.

The Glasgow Corporation tramway accounts for the year ending May 31st last form a most interesting record, which will doubtless attract attention from a far wider circle than that represented by the "guid folk of Glasga." Financially, the undertaking is a prosperous, nay, wealthy concern, as will be gathered from the following figures at the date mentioned:—

The total amount of borrowed capital was £2,044,644; the amount of interest and sinking fund repaid was £247,805; the balance standing to the credit of the depreciation and permanent way renewals fund is now £777,637, and a further amount of £32,590 is credited to a general reserve fund. Furthermore, since the tramways were opened in 1894, the ratepayers have received out of the profits payments to the common good amounting to £156,760, and the buildings, generating and tramways plant have been kept in an efficient condition out of revenue. We are not aware of any tramway in the world with such a creditable record as this, and the Glasgow authorities may well be excused the pardonable pride with which they regard their undertaking.

From the report we gather that the result of the year's working shows that the income amounted to £764,791, and the working expenses to £387,167, leaving a gross profit of £377,624. The gross profit of £377,624 has been applied in meeting the rental of Govan and Ibrox tramways, payment to Paisley District Tramways Co., interest on capital, sinking fund, income-tax, depreciation and permanent way renewals, Parliamentary expenses, and annual payment to the common good, these payments amounting in all to £287,438. The net balance remaining amounts to £93,298, of which £68,500 has been applied in meeting special depreciation on buildings, ducts, cables, overhead equipment, and power station and sub-stations plant, the balance of £24,798 being added to the general reserve fund.

The total route mileage in operation amounts to 73¾ miles, of which 5½ miles are leased, and the population served by tramways (city and suburbs) is one million. From the analysis it will be seen that the last year's results compare very favourably with those of the previous year; the average profit per car-mile was fractionally less than in 1904, but the total profit over the increased mileage showed a considerable increase.

In accordance with agreement the electricity department were supplied with 1,243,532 units, and it has been arranged that a constant supply shall be given to that department through the Whitevale sub-station, also that in the coming winter the output of three engines shall be at the E.L. department's disposal.

From the power statistics we gather that ordinary working expenses, inclusive of repairs to steam and electrical plant, &c., amounted to ·30d. per unit. Taxes, premiums and management brought this up to ·35d., and the further addition of interest, sinking fund and depreciation made a total of 1·13d. per unit. The maximum load on the power station was 8,517 kw., and exclusive of the supply to the electricity department, 6,300 kw. The load factors in the two cases were 30·8 per cent. and 41 per cent. respectively.

General Statement.

For 12 months ending May 31st ...	1905.	1904.
Length of route	73¾ miles.	72 miles.
Total length of track	144¼ „	140 „
Average number of cars in use ...	448·59	462·12
Car-miles run	17,943,595	16,291,082
Passengers carried per annum... ...	195,767,519	188,962,610
Capital expended to date	£2,776,246	£2,699,776
Traffic receipts	£756,480	£717,893
Total receipts	£764,791	£724,851
Working expenses	£387,167	£356,820
Gross profit	£377,624	£368,031
Income per car-mile	10·23d.	10·68d.
Working expenses per car-mile ...	5·18d.	5·26d.
Interest and sinking fund per car-mile	1·30d.	1·62d.
Rental of leased lines...	·08d.	·07d.
Total expenses per car-mile	6·56d.	6·95d.
Profit or loss per car-mile	3·67d.	3·73d.
Cost of energy per car-mile	·324d.	·30d.
Average fare per passenger	·93d.	·91d.
„ „ charged per mile ...	·46d.	·45d.
Revenue per mile of route	£10,335	£10,067
Expenditure per mile of route ...	£5,232	£4,956
Total tramway units used	20,268,407	15,372,609
Tramway units used per car-mile ...	1·13	·94
Percentage of working ex'es to receipts	50·42	49·25

The gross profit of £377,624, together with interest on surplus revenue, making a total of £380,736, were allocated as follows:—

Interest on capital...	£49,906
Sinking fund	46,919
Income-tax	5,434
Rental of Govan and Ibrox Tramways	5,081
Payment to Paisley District Tramways Co. ...	915
Depreciation	81,115
Permanent way renewals fund	72,177
Parliamentary expenses	891
Payment to common good in terms of arrangement	25,000
Net balance...	93,298
	£380,736

The net balance was appropriated as stated previously. In conclusion, we may say that Mr. Jas. Dalrymple is the general manager, he having succeeded Mr. John Young in October last.

CITY NOTES.

Yorkshire Electric Power Co.

The directors' report to be presented at the half-yearly meeting to be held at Ravensthorpe, on Tuesday, September 26th, reads:—"Since the last report the first two turbo-generators have been erected in the Thornhill power station, and are now working. It is expected that the third turbo-generator, which will complete the present order for generating machinery, will be installed during the autumn. The equipment for sub-stations at Thornhill, Mirfield, Gomersal, and Pudsey, is practically completed and is now in use. The transmission mains referred to in the January report have been laid, and the distribution mains and service equipment necessary to connect consumers are being proceeded with. A supply of energy was given to the Mirfield Urban District Council on July 7th, and to the Pudsey Corporation on August 23rd, and the supply to other consumers is being given as their installations are ready. It is satisfactory to report that it has been possible, without serious opposition, to arrange clauses in the Parliamentary Bills affecting the company, by which the interests of the company have been protected. At the conclusion of the general business an extraordinary meeting will be held to consider the desirability of passing, and if deemed expedient, to pass necessary resolutions to obtain further moneys to develop the company, and carry the transmission mains into other districts in which a good demand for power is anticipated. The meetings will be held in Ravensthorpe to give shareholders the opportunity to visit the power station and other works of the company in the neighbourhood."

United Electric Car Co., Ltd., Preston.—The report of this company (late the Electric Railway and Tramway Carriage Works, Ltd.) for the year ending June 30th, 1905, says that the works have been efficiently maintained as regards buildings and machinery, the cost of which has been charged against revenue. After paying debenture interest amounting to £2,500, and charging £4,315 for depreciation, the profit for the year is £15,189, to which is added £2,873 brought forward from last year, making a total of £18,062. The directors recommend a dividend of 8 per cent. = £12,000; to carry to general reserve £2,000; and to carry forward to next year £4,062.

The Lancashire Electric Power Co.

The tenth ordinary meeting of this company was held at Broad Sanctuary Chambers, Westminster, on Thursday, 31st ult., Mr. F. E. Gripper presiding.

The Chairman said he was pleased to be able to state that they were on the eve of commencement of supply. Their main cables were practically laid to Swindon and Pendlebury and Westhoughton, and the company would be in a position to supply those urban districts during the coming month. A provisional order had been obtained for the urban district of Tottington and the laying of their main cable through that district and on to Bacup was well in hand, and by the end of this, or early in the coming year, it was expected that the company would be fully working.

Chloride Electrical Storage Co.

The annual general meeting of this company was held at the works, Clifton Junction, on Wednesday, August 23rd, Mr. W. Bannister, J.P., presiding. The report, which was published in our issue of August 14th, was adopted.

The retiring directors—Messrs. W. Bannister and J. de Berniere Smith—were re-elected, and Messrs. Parkinson, Mather and Co. were reappointed auditors.

The meeting closed with a vote of thanks to the directors and the staff for their services during the year, and to the chairman.

An extraordinary meeting was afterwards held for the purpose of making certain alterations in the articles of association, which were unanimously decided upon.

The shareholders were subsequently entertained, and conducted through the new extensive works, the different processes employed being explained to them.

Stock Exchange Notices. — The Committee has appointed special settling days as under:—

Wednesday, September 13th.—Durham Collieries Electric Power Co., Ltd.—85,102 6 per cent. cumulative preference and participating shares of £1 each fully paid, Nos. 1 to 85,102.

London United Tramways (1901), Ltd.—Further issue of £300,000 4 per cent. first mortgage debenture stock.

And ordered the undermentioned securities to be quoted in the Official List:—

London United Tramways (1901), Ltd.—Further issue of £300,000 4 per cent. first mortgage debenture stock.

River Plate Electricity Co., Ltd.—119,694 ordinary shares of £1 each fully paid, Nos. 1 to 119,687 and 120,501 to 120,507, 100,000 6 per cent. non-cumulative preference shares of £1 each fully paid, Nos. 1 to 100,000, and £194,684 5 per cent. debenture stock.

Application has been made to the Committee to appoint a special settling day in and to grant a quotation to:—

Electric Supply Co. of Victoria, Ltd.—£160,000 5 per cent. first mortgage debenture stock.

J. Stone & Co., Ltd.—20,000 5 per cent. cumulative preference shares of £10 each, fully paid, Nos. 1 to 20,000.

Isle of Thanet Electric Tramways and Lighting Co.—The directors have issued a circular to the shareholders, stating that in view of the recent accident at Ramsgate the board has decided to defer making any payment on account of the second half-year's preference dividend, usually paid on September 1st, until after the accounts for the company's financial year, which ends on September 30th, are made up and audited.

Stewarts and Lloyds.—The directors have declared an interim dividend at the rate of 9 per cent. per annum on the ordinary shares for the half-year ended June 30th last.

Utah Light and Railway Co. of Salt Lake City, U.S.A.—Summary of earnings and expenses for June, 1905:—

	1905.	1904.
Gross income	$108,125.98	$102,419.70
Less operating, general and maintenance expenses	71,840.67	67,247.82
Net from operating	$36,285.31	$35,171.88

Chelsea Electricity Supply Co.—The directors have declared an interim dividend on the ordinary shares for the half-year to June 30th of 2s. 3d. per share, or at the rate of 4½ per cent. per annum, payable September 15th.

South Metropolitan Electric Light and Power Co.—The warrants for the payment of the dividend on the 7 per cent. cumulative preference shares payable on August 31st were posted last week.

STOCKS AND SHARES.

Wednesday evening.

Speculation rather than investment is providing the main business of the Stock Exchange, although "peace markets" in all departments are the order of the day. The cloud of dearer money is plainly perceptible, and while the Stock Exchange can easily stand a higher Bank rate, the possible raising of the minimum induces a certain caution that goes some way to restrain prices. Thus again is verified the Stock Exchange saying that "there is always something"—— to check business.

Falls are very inconspicuous in the electrical prices. The section to show the most marked strength is that devoted to telegraphs and telephones, where trade has broadened out considerably under the kindly influence of investment purchases. Globe Telegraph and Trust Preference shares are ⅛ harder, an index to the improvement in prices generally. The Eastern group, for some time dormant, begins to attract more attention, and Eastern Telegraph Ordinary is again a point higher at 145½, though China shares remain at 14, which is relatively too low. The declaration of peace will, it is considered, be a good thing for both companies, because any loss of war traffic should be more than compensated by the impulse given to commerce. Amazon shares recovered 5s. of their sharp drop, and the debentures, to which attention was directed here a fortnight ago, are 7 up. Cuba Telegraph Preference rose ½ to 18, upon the remarkable progress now being made by the island. West African Telegraphs have improved a further 5s., despite the deadness of the "Jungle" market, and West India Second Preferences have been singled out for favour. Another 10s. advance took Indo-Europeans to 53½, but Great Northerns have not moved from 35½, although the close of the war should also benefit this company's lines. A few Debentures rose a point, and the only falls to be recorded are in Anglo-American Telegraphs, where the "A" and "B" stocks are both easier.

Following the strength of this market, Telegraph Constructions put on 30s., making a rise of 50s. in two weeks. There are very few shares in supply, and several persistent buyers. Henley's are also distinctly better, the rise of ½ to 12½ being in addition to the recovered dividend of 3s. per share taken off last week. The Preference are *ex* 2s. 3d., and are nominally ¼ lower at 5¼, but the Debenture stock at 110 *ex* 2¼ per cent. interest, is unchanged from its previous *cum* dividend price. British Insulated Ordinary and Preference each rose 5s., and the Debenture stock a point.

Other alterations in the manufacturing division comprise improvements of $\frac{1}{16}$ in Electric Constructions to $\frac{3}{16}$, and of a point in Crompton Debentures, while Callender's Debenture came into renewed demand, and is 1½ up.

Amongst electrical railway stocks, Central London Ordinary spurted 2 to 91, upon its inclusion in the range of 4½ per cent. stocks, for which investors are searching the markets. City and South London found buyers at 41⅜. Districts remain at 36, and Metropolitan put on the fraction at 92¼. Great Northern and City Preferred are ignored at 5¼, Brompton Ordinary are 8½, and the Debenture stock is 75½, which is ½ higher than the Charing Cross and Euston Debenture, both the latter being 75 per cent. paid. The reason for the excision of East London "B" Debenture from the Official List is the paucity of business negotiated in the stock, the price of which stands about 30.

Electricity Supply shares are mostly better on balance, although slight weakness is displayed by Charing Cross City Undertaking Preference, Chelsea Ordinary, and Brompton Ordinary. Rises of ⅛ have been secured by City Ordinary at 10⅞, Edmundson's Preference at 6¼, and Kensington Ordinary at 12⅜. Metropolitan Ordinary and Preference are the same sum better at 10⅝ and 5¾ respectively, but Smithfields gave way ⅛ to 2½. Business in this department is of the usual steady character, but the market has its share in the generally more active state of investment orders.

Those new power companies are a long time making up their minds to face the music of a public issue. It would be an excellent idea on the part of one of them to prepare a pamphlet for the general public stating in understandable terms what an electric power company is and what it is intended to do.

Traction issues are somewhat irregular. British Electric Ordinary dropped another ⅛ to 8¼, the Preference keeping at 10⅞. Anglo-Argentine Ordinary, marvellous to say, eased off to 9, and can be bought cheaper than this. A hint was given last week about Havana Electric coupon-bonds; the price has risen 3 points to 99. Isle of Thanets are fairly active at a shade under 2⅜, and London United Preference stay at 10. Notice must be made of a small rise in British Columbia Electric Preferred Ordinary to 103½. The Deferred at 113½ is also better, and might easily be put to 120. Belgrano Ordinary are 3⅛. London Road Cars are 6⅜, and L.G.O. stock about 125.

National Telephone descriptions are a little harder, and United River Plate Preference rose ⅛ to 5⅜, Chili Telephones going ⅛ better with an improvement of 5s. at 7½. Oriental Telephones at 1¼ for each class of shares keep steady.

SHARE LIST OF ELECTRICAL COMPANIES.

TELEGRAPH AND TELEPHONE COMPANIES.

Present Issue.	NAME.	Stock or Share. ‡	Dividends for the last four years. 1902.	1903.	1904.	1905. §	Closing Quotations August 30th.	Closing Quotations Sept. 6th.	Business done week ended Sept. 6th, 1905. Highest.	Lowest.	Rise + or Fall −
34,800	African Direct Telegraph, 4 % Debs.	100	4 %	4 %	4 %	..	99 —102	99—102	..	..	..
25,000	Amazon Telegraph Co.'s shares, Nos. 1 to 25,000	10	Nil	Nil	Nil	..	2⅜— 3⅛	3 — 3⅛	3⅛	..	+ ⅛
119,700£	Do. do. 5 % Debs., Nos. 1 to 1,250 Red.	100	Nil	Nil	Nil	..	75 — 80	82 — 87	83	79½	−3
763,580	Anglo-American Telegraph	Stock	60/6	61s.	22½	20s.	59 — 61	59 — 61	..	..	..
3,118,210	Do. do. do. 6 % Pref.	Stock	6 %	6 %	5¼ %	5s.	106 —107	105¼—106½	106⅜	105½	− ⅛
3,118,210	Do. do. do. Deferred	Stock	1/-	2s.	Nil	..	15⅜— 15⅞	15 — 15⅛	15⅜	15⅛	− ⅛
44,000	Chili Telephone, Nos. 1 to 44,000	5	6 %	7 %	8 %	..	7⅛— 7⅜	7⅜— 7⅝	7⅝	7.5/8	+ ⅛
1,932,856£	Commercial Cable Stng. 500 year 4 % Deb. Sk. Red.	Stock	4 %	4 %	4 %	..	96½— 96¾	96½— 96⅝	96	97½	..
16,000	Cuba Telegraph	10	6½%	10 %	5 %	..	8½ — 9⅛	8½ — 9⅛	9 1/16	..	..
6,000	Do. —10 % Pref.	10	10 %	5 %	10 %	..	17 — 18	17½ — 18½	..	..	+ ½
12,931	Direct Spanish Telegraph, Ord.	5	4 %	4 %	4 %	..	3⅜ — 3⅝	3⅜ — 3⅝	..	..	..
6,000	Do. do. 10 % Cum. Pref.	5	10 %	10 %	10 %	..	9½ — 9⅝	9½ — 9⅝	..	..	..
30,000	Do. do. 4½ % Debs.	50	4½%	4½%	4½%	..	100 —103	100 —103	..	..	..
60,710£	Direct United States Cable	20	3½%	3 %	3½%	..	11⅝— 11⅞	11⅞— 12	11 11/16	11⅞	+ ⅛
74,500	Direct W. India Cable, 4½ % Reg. Deb., 1 to 1,900, R.	100	4½%	4½%	4½%	..	100 —102	100 —102	..	..	..
4,000,000	Eastern Telegraph, Ord. Stock	Stock	7 %	7 %	7 %	..	143 —146	144 —147	146⅝	144½	+ 1
2,000,000	Do. 3½ % Pref. Stock	100	3½%	3½%	3½%	..	90½— 92½	90 — 92	91	90½	− ½
1,636,814	Do. 4 % Mort. Deb. Stock Red.	Stock	4 %	4 %	4 %	..	108 —110	108 —110	..	..	..
300,000	Eastern Extension, Australiasia, and China Tele.	10	7 %	7 %	7 %	..	13⅜— 14½	13⅜— 14½	14½	13 15/16	..
602,400	Do. 4 % Deb. Stock	Stock	4 %	4 %	4 %	..	105½—107½	106 —108	107½	..	..
300,000	East & S. Afric. Tel., 4 % Mt. Db., 1 to 3,000, red. 1909	100	4 %	4 %	4 %	..	99½—101½	99½—101½	..	..	..
200,000£	Do. 4 % Reg. M. Debs. (Mauritius Sub.) 1 to 8,000	25	4 %	4 %	4 %	..	101½—103⅜%	101½—103½	..	..	..
180,887	Globe Telegraph and Trust	10	£3 16 7*	5½%	5½%	..	10⅝— 10¾	10⅝— 11	11	10⅞	+ ⅛
180,887	Do. do. 6 % Pref.	10	6 %	6 %	6 %	..	14⅜— 14⅝	14⅜— 14⅝	14⅝	14 7/16	..
150,000	Great Northern Telegraph, of Copenhagen	10	12½%	15 %	24 %	..	35 — 36	35 — 36	35½	35⅜	..
46,500	Halifax and Bermudas Cable, 4½ % 1st Mort. Debs., within Nos. 1 to 1,200, Red.	100	4½%	4½%	4½%	..	100 —102	100 —102	..	..	..
17,000	Indo-European Telegraph	25	10 %	10 %	13 %	..	52 — 54	52¼— 54½	53⅛	53½	+ ½
72,680	Monte Video Telephone Co., Ltd. Ord.	1	3 %	3 %	..	..	⅜— ½	⅜— ½	..	..	..
1,983,333	National Telephone, Pref. Stock	100	6 %	6 %	6 %	6 %	110 —111	111 —112	111½	110½	+1
1,966,667	Do. do. Def. Stock	100	4½%	5 %	5 %	5 %	107⅛—108½	107⅛—109½	108⅜	107⅛	+ ½
15,000	Do. do. 6 % Cum. 1st Pref.	10	6 %	6 %	6 %	6 %	13 — 14	13½— 14½	14	..	+ ½
15,000	Do. do. 6 % Cum. 2nd Pref.	10	6 %	6 %	6 %	6 %	12 — 13	12 — 13	..	..	..
250,000	Do. do. 5 % Non-cum. 3rd P., 1 to 250,000	5	5 %	5 %	5 %	5 %	5⅜— 5⅝	5⅜— 5⅝	5 11/16	..	..
2,000,000	Do. do. 3½ % Deb. Stock Red.	Stock	3½%	3½%	3½%	..	99½—101½	99½—100½	100	..	..
1,689,598	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	..	104 —106	104 —106	105⅜	105	..
179,313	Oriental Telep. and Elec. 1 to 171,504, fully paid	1	6 %	6½%	6½%	..	1 3/16— 1 5/16	1 3/16— 1 5/16	..	..	..
50,000	Do. do. do. 6 % Cum. Pref.	1	6 %	6 %	6 %	..	1 7/16— 1 9/16	1 7/16— 1 9/16	..	..	..
100,000	Pacific & European Tel., 4 % Guar. Debs., 1 to 1,000	100	4 %	4 %	4 %	..	99 —102	100 —103	..	..	+1
11,839£	Reuter's	8	5 %	5 %	5 %	..	7½ — 8	7⅞— 8⅛	8⅛	7⅞	+ ⅛
3,237	Submarine Cables Trust	Cert.	6 %	6 %	6 %	..	127 —130	127 —130	..	..	..
58,000	United River Plate Telephone	5	7 %	8 %	8 %	..	7 — 7⅛	7 — 7⅛	7⅛	..	..
40,000	Do. 5 % Cum. Pref., Nos. 1 to 40,000	5	5 %	5 %	5 %	..	5⅛ — 5⅜	5⅛ — 5⅜	..	..	+ ⅛
179,947	Do. do. 5 % Debs.	Stock	5 %	5 %	5 %	..	109 —111	109½—111½	..	..	+ ½
15,609£	West African Telegraph, Shares	10	2·5%	4 %	4½%	..	9⅞— 10⅛	10 — 10⅛	..	..	+ ¼
30,008	W. Coast of America, 1 to 30,000 & 53,001 to 53,008	2½	Nil	Nil	Nil	..	5/16— 7/16	5/16— 7/16	..	..	..
150,000	Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4 %	4 %	4 %	..	100 —102	100 —102	..	..	..
207,930	Western Telegraph, Ltd., Nos. 1 to 207,930	10	7 %	7 %	7 %	..	13⅜— 14½	13⅜— 14½	14 3/16	14	..
75,000	Do. do. 5 % Debs. 2nd series, 1906	100	5 %	5 %	5 %	..	100 —102	101 —103	..	..	+1
563,880	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	..	102½—104½	102½—104½	103	..	..
88,321	West India and Panama Telegraph	10	Nil	Nil	Nil	..	1/16— 1/8	1/16— 1/8	..	..	..
34,563	Do. do. 6 % Cum. 1st Pref.	10	7 %	7 %	6 %	..	8⅞— 9	8⅞— 9	..	..	..
4,669	Do. do. 6 % Cum. 2nd Pref.	10	Nil	Nil	Nil	..	6½— 7	6½— 7⅛	6 1/16	6⅝	+ ⅛
80,000£	Do. do. 5 % Debs., Nos. 1 to 1,800	100	5 %	5 %	5 %	..	101 —104	101 —104	..	..	..

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.

40,000	British Aluminium 7 % Cum. Pref.	5	Nil	Nil	Nil	..	4⅜— 5⅛	4⅜— 5⅛	5 1/16	..	..
20,000	Do. do. "A" 6 % Cum. Pref.	5	Nil	Nil	Nil	..	4⅜— 5⅛	4⅜— 5⅛	4 15/16	..	..
20,000	Do. do. 4 % Funding Certs.	5	..	..	..	..	2⅛— 3⅛	2⅛— 3⅛	..	..	..
300,000£	Do. do. 5 % 1st Mort. Deb. Stock Red.	Stock	5 %	5 %	5 %	..	99 —103	99 —103	..	..	..
133,301	British Electric Traction	10	8 %	6 %	6 %	..	8⅛— 8⅝	8 — 8½	8⅜	8⅛	− ⅛
156,437	Do. do. 6 % Cum. Pref.	10	6 %	6 %	6 %	..	10½— 11	10¼— 11	10 1/16	10⅛	..
1,000,000£	Do. do. 5 % Perp. Deb. Stock	Stock	5 %	5 %	5 %	..	123 —125	123 —125	..	..	..
250,000	Do. do. 4½ % 2nd Deb. Stock Red.	100	..	..	4½%	..	98 —100	98 — 100	99⅛	96⅜	..
100,000	British Insulated and Helsby Cables	5	10 %	8 %	8 %	8 %	5½ — 6	5⅝ — 6⅛	5 13/16	..	+ ⅛
100,000	Do. do. 6 % Cum. Pref.	5	6 %	6 %	6 %	6 %	5½ — 6	5⅝ — 6⅛	6	..	+ ⅛
500,000	Do. do. 4½ % 1st Mort. Deb. Red.	100	4½%	4½%	4½%	4½%	102 —105	103 —106	..	..	+1
50,000	¶Browett, Lindley & Co., Ord.	£1	Nil	Nil	Nil	..	15/16— 1 1/16	15/16— 1 1/16	..	..	..
50,000	¶ Do. do. 6 % Cum. Pref.	£1	Nil	Nil	Nil	..	14/6 to 15/6	14/6 to 15/6	..	..	..
105,731	Brush Electrical Engineering, Ord., 1 to 105,731	2	Nil	Nil	Nil	..	1⅝— 1¾	1⅝— 1¾	..	..	..
150,000	Do. Non-cum. 6 % Pref.	2	6 %	6 %	6 %	..	1½— 1⅝	1½— 1⅝	..	..	..
125,000£	Do. 4½ % Perp. Deb. Stock	Stock	4½%	4½%	4½%	..	92 — 95	90 — 93 xd	..	..	..
125,000£	Do. 4½ % Perp. 2nd Deb. Stock	Stock	4½%	4½%	4½%	..	78 — 81	78 — 81	..	..	..
35,000	Callender's Cable Construction shares	5	15 %	12½%	12½%	..	10 — 11	10 — 11	..	..	..
40,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	..	5¼— 5⅜	5¼— 5⅜	..	..	..
¶ 500,000	Do. do. 4½ % 1st Mort. Deb. Stock Red.	Stock	4½%	4½%	4½%	..	107 —109	108½—110½	109½	..	+1½
1,963,208	Central London Railway, Ord. Stock	Stock	4 %	4 %	4 %	4 %	88 — 90	90 — 92	91	90	+2
523,396	Do. do. 4 % Pref. Stock	Stock	4 %	4 %	4 %	4 %	101 —103	101 —103	..	..	..
523,396	Do. do. Def. do.	Stock	4 %	4 %	4 %	..	77 — 80	77 — 80	..	..	..
1,330,000	City and South London Railway	Stock	3½%	2⅔%	2½%	2 %	40 — 42	40 — 42	41⅞	41	..
85,000	Crompton & Co., Nos. 1 to 85,000	3	5 %	2½%	2½%	..	1⅛— 1⅜	1⅛— 1⅜	..	..	..
100,000£	Do. 5 % 1st Mort. Reg. Debs., 1 to 900 of £100, and 901 to 11,000 of £50 Red.	..	5 %	5 %	5 %	..	94 — 99½	95 —100	98½	..	+1
99,261	Edison & Swan Utd., "A" shrs., £3 pd., 1 to 99,261	5	Nil	Nil	..	..	1⅛— 1⅜	1⅛— 1⅜	1⅜	..	..
17,139	Do. "A" shares, 01—017,139	5	Nil	Nil	..	..	2 — 2½	2 — 2½	2 3/16	..	..
344,023£	Do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	..	83 — 88	83 — 88	83	..	..
100,000£	Do. 5 % 2nd Deb. Stock Prov. Certs. all pd.	100	5 %	5 %	5 %	..	89 — 94	89 — 94	..	..	..
112,106	Electric Construction 1 to 112,100	2	6 %	4 %	Nil	..	¾— ⅞	¾— 1	..	..	+ ⅛
31,390	Do. do. 7 % Cum. Pref., 1 to 31,390	2	7 %	7 %	7 %	..	1⅛— 2⅛	1⅛— 2⅛	..	..	..
200,000	Do. do. 4 % Perp. 1st Mort. Deb. Sk.	Stock	4 %	4 %	4 %	..	92 — 95	92 — 95	..	..	..
25,000	General Electric Co. (1900), 5 % Cum. Pref.	10	5 %	5 %	5 %	..	9⅛— 10	9⅛— 10	..	..	..
200,000	Do. do. 4 % Mort. Deb.	Stock	4 %	4 %	4 %	..	97 —101	97 —101	..	..	..
200,000	Henley's (W. T.), Telegraph Works, Ord.	5	20	15 %	15 %	10%	11½— 12⅛	12 — 13 xd	12⅛	12⅛	..
200,000	Do. do. 4½ % Pref.	5	4½%	4½%	4½%	..	5⅜— 5⅝	5⅛— 5½ xd	5 1/16	5½	..
45,900	Do. do. 4½ Mort. Deb. Stock	Stock	4½%	4½%	4½%	..	109 —111	109 —111 xd	..	..	..
50,000	India-Rubber, Gutta-Percha & Telegraph Works.	10	10 %	10 %	..	..	15½— 16½	15½— 16½	..	..	..
800,000£	Do. do. 4% 1st Mort. Deb.	100	4 %	4 %	4 %	..	100 —103	103 —103	..	..	..
37,500	†Liverpool Overhead Railway, Ord.	10	1½%	1½%	1½%	..	2⅞— 3	2⅞— 3	..	..	..
10,000	† Do. do. Pref. £10 paid	10	5 %	5 %	5 %	5 %	9 — 9½	9 — 9½	..	..	..
37,350	Telegraph Construction and Maintenance	20	20 %	15 %	..	..	33 — 35	34½— 36½	35⅞	34	+1½
150,000£	Do. 4 % Deb. Bds., 1 to 1,500 Red. 1909	100	4 %	4 %	4 %	..	102 —104	102 —110	..	..	+3
540,000£	Waterloo & City Railway, Ord. Stock	100	3½%	3½%	3½%	3 %	90 — 92	90 — 92	..	..	..

* A period of nine months. † Quotations on Liverpool Stock Exchange. ‡ Unless otherwise stated all shares are fully paid. § Interim dividends.
¶ From Manchester Share List.

Bank rate of discount 2½ per cent. (March 9th, 1905).

SHARE LIST OF ELECTRICAL COMPANIES *(continued)*.—ELECTRICITY SUPPLY COMPANIES.

Present Issue.	NAME.	Stock or Share.	Dividends for the last four years. 1902.	1903.	1904.	‡1905.	Closing Quotations Aug. 30th.	Closing Quotations Sept. 6th.	Business done week ended Sept. 6th, 1905. Highest	Lowest.	Rise + or Fall—
29,377	Brompton & Kens. Elec. Lt. Sup., Ord., 1 to 20,000	†	8 %	10 %	10 %	..	10 — 10¼	9¾ — 10¼	10¼	..	—¼
10,623	Do. do. 7 % Cum. Pref.	5	7 %	7 %	7 %	..	9⅝ — 10⅛	9⅝ — 10⅛	..	..	..
288,782	Central Electric Supply 4 % Guar. Deb. Stock ..	100	4 %	4 %	4 %	..	103 —106	103 —106	105½	104¾	..
80,000	Charing Cross and Strand Electricity Supply ..	5	10 %	8 %	8 %	5 %	6¾ — 7⅛	6¾ — 7⅛	7	6⅞	..
80,000	Do. do. do. 4½ % Cum. Pref.	5	4½%	4½%	4½%	..	5⅛ — 5⅜	5⅛ — 5⅜	5⅜	..	..
40,000	Do. "City Undertaking" 4½ % Cum. Prf.	5	4½%	4½%	4½%	..	4 15/16 — 5 1/16	4 15/16 — 5 1/16	..	..	..
40,000	Do. do. 1903	5	..	4½%	4½%	..	4⅞ — 5⅛	4⅞ — 5⅛	..	..	..
350,000	Do. do. 4 % Deb. Stock Red. ..	100	4 %	4 %	4 %	..	103 —105	103 —105	104	..	..
44,436	*Chelsea Electricity Supply, Ord.	5	4½%	5¾%	6 %	4½%	6⅛ — 6⅝	6 — 6½	6⅛	..	—⅛
150,000‡	Do. do. 4½ % Deb. Stock Red. ..	Stock	4½%	4½%	4½%	4½%	108 —110	108 —110	..	..	..
70,595	City of London Elec. Lighting, Ord. 40,001—110,595	10	5 %	5 %	6 %	..	10¾ — 11	10⅞ — 11⅛	10⅞	10⅝	+⅛
40,000	Do. 6 % Cum. Pref., 1 to 40,000	10	6 %	6 %	6 %	..	13 — 14	13 — 14	13½	..	..
400,000‡	Do. 5 % Db. Stk., Scrip. (iss. at 115) all pd.	..	5 %	5 %	5 %	..	123 —127	123 —127	125	..	..
300,000	Do. 4½ % 2nd Db. Stk., Prov. Crts., all pd.	100	4½%	4½%	4½%	..	103 —105	103 —105	..	..	..
40,000	County of London Electric Lighting, Ord. 1—40,000	10	4 %	4 %	4½%	4 %	8½ — 9	8½ — 9	8⅝	..	..
30,000	Do. do. 6 % Pref., 40,001—60,000	10	6 %	6 %	6 %	..	12 — 12½	12 — 12½	..	..	..
400,000‡	Do. do. 4½ % Deb. Stock ..	..	4½%	4½%	4½%	..	111 —114	111 —114	113⅜	112⅝	..
250,000	Do. do. 4½ % 2nd Deb. Stock ..	Stock	4½%	4½%	4½%	..	103 —105	103 —105	104	..	..
70,000	Edmundson's Electric Corporation, Ord. Shares ..	5	7 %	7 %	7 %	..	5⅞ — 6¼	5⅞ — 6¼	..	..	..
80,000	Do. do. 6 % Cum. Pref... ..	..	6 %	6 %	6 %	..	6 1/16 — 6 3/16	6 1/16 — 6 3/16	6 3/16	6 5/32	..
300,000‡	Do. do. 4½ % 1st Mort Deb. Stk	100	4½%	4½%	4½%	..	106 —108	106 —108	..	..	..
21,000	Kensington and Knightsbridge Electric Ord. ..	5	10 %	12 %	12 %	..	11⅞ — 12⅞	12 — 12⅝	12 7/16	12¼	+⅛
136,000	Do. do. do. 4 % Deben. Stk.	Stock	4 %	4 %	4 %	..	97 —100	97 —100	..	..	..
111,000	London Electric Supply Corporation, Limited, Ord.	3	Nil	Nil	3 %	..	2 — 2⅛	2 — 2⅛	..	..	..
60,000	Do. do. do. 6 % Pref...	5	6 %	6 %	6 %	..	5 — 5¼	4⅞ — 5⅛xd	5	..	..
371,895	Do. do. 4 % 1st Mort. Deb. Stk. Red.	Stock	4 %	4 %	4 %	..	99 —102	99 —102	..	..	..
100,000	Metropolitan Electric Supply, 1 to 100,000	5	7½%	8¾%	10 %	10%	10¼ — 10⅝	10⅜ — 10⅝	10 11/16	10¼	+⅛
76,121	Do. 4½ % Cum. Pref. 1—71,106, £3 pd.	5	4½%	4½%	4½%	..	5⅜ — 5½	5⅜ — 5⅝	5¾	5⅝	+⅛
220,000‡	Do. 4½ % 1st Mort. Deben. Stock ..	..	4½%	4½%	4½%	..	109 —113	109 —113	..	..	..
250,000‡	Do. 3½ % Mort. Deben. Stock Redem.	Stock	3½%	3½%	3½%	..	98 —100	99 —101	..	..	+1
250,000	Midland Electric Corporation, 4½ % 1st Mort. Deb.	100	4½%	4½%	4½%	..	99 —101%	99 —101%	101	..	..
10,852	Notting Hill Electric Lighting	10	6 %	6 %	7 %	..	14 — 15	14 — 15	..	..	..
59,000	Do. do. 4 % 1st Mort. Deb... ..	100	4 %	4 %	4 %	..	100 —102	100 —102	..	..	..
40,000	St. James' and Pall Mall Electric Light, Ord. ..	5	14½%	14½%	14½%	10%	13½ — 14½	13½ — 14½	..	..	..
20,000	Do. do. 7 % Pref. 20,081 to 40,080	5	7 %	7 %	7 %	7 %	8 — 9	8 — 9	..	..	..
150,000‡	Do. do. 3½ % Deb. Stock Red. ..	100	3½%	3½%	3½%	..	97 — 99	97 — 99	..	..	..
12,000	Smithfield Markets Electric Supply, Ord.	5	2½%	4 %	4 %	..	2⅜ — 2⅝	2⅛ — 2⅜	..	..	—⅛
50,000	Do. do. do. 4 % Deb. Stock	Stock	4 %	4 %	4 %	..	76 — 80	76 — 80	..	..	..
65,000	South London Electricity Supply, Ord.	5	1¾%	3 %	4 %	..	3½ — 4	3½ — 4	..	..	..
100,000	South Met. Elec. Lt. & Power Ord.. ..	1	Nil	Nil	Nil	..	15/16 — 1 1/16	15/16 — 1 1/16	..	..	..
50,000	*(Late Blackheath and Greenwich* 7 % Pref... ..	1	Nil	7 %	7 %	..	1 1/16 — 1 1/16	1⅛ — 1⅜xd	..	..	..
100,000	*Dist. E.L.Co.)* 4½ % 1st Deb. Stk.	100	4½%	4½%	4½%	..	106 —109	106 —109	..	..	..
30,000	Urban Electric Supply, Ord.	5	5 %	5 %	5 %	..	4⅝ — 4¾	4 11/16 — 4 13/16	4¾	..	+1/16
30,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	..	5⅛ — 5⅜	5⅛ — 5⅜	..	..	..
200,000	Do. do. 4½ % 1st Mort. Db. Stk. Red	100	..	..	4½%	..	105 —107	105 —107	..	..	..
110,000	Westminster Electric Supply, Ord.	5	12 %	13½%	14 %	13%	12⅛ — 13⅛	12⅜ — 13⅛	13	..	+⅛
28,151	Do. do. 5 % Cum. Pref. ..	5	5 %	5 %	5 %	..	6⅛ — 6⅜	6⅛ — 6⅜	..	..	..

Shares not officially quoted:—Mackay Companies, ord., 41¼—42. Pref. 75¾—76¼.

* Subject to Founders Shares. † Unless otherwise stated all shares are fully paid. ‡ Interim dividends.

MARKET QUOTATIONS, Wednesday, September 6th.

	CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a	Acid, Hydrochloric	per cwt.	5/-	..
a	,, Nitric	per cwt.	22/-	..
a	,, Oxalic	per cwt.	32/-	..
a	,, Sulphuric	per cwt.	5/6	..
a	Ammoniac, Sal	per cwt.	42/-	..
a	Ammonia, Muriate (crystal) ..	per ton	£33 10	..
a	,, ,, ...	per ton	£30	..
a	Bleaching powder	per ton	£5 10	..
a	Bisulphide of Carbon	per ton	£15	..
a	Borax	per ton	£13	..
a	Benzole (90 %)	per gal.	7/-	..
a	,, (50 %)	per gal.	5/6	..
a	Copper Sulphate	per ton	£20	..
a	Lead, Nitrate	per ton	£25	..
a	,, White Sugar	per ton	£31	..
a	,, Peroxide	per ton	£27 10	..
a	Methylated Spirit	per gal.	2/6	..
a	Naphtha, Solvent (90 % at 160° C)	per gal.	5/6	..
a	Potassium Bichromate, in casks	per lb.	3d.	..
a	Potash, Caustic (75/80 %) ..	per ton	£20	..
a	Potassium Cyanide	per lb.	7½d.	..
a	Shellac	per cwt.	190/-	..
a	Sulphate of Magnesia	per ton	£4 10	..
a	Sulphur, Sublimed Flowers ..	per ton	£6 10	..
a	,, Recovered	per ton	£5 10	..
a	,, Lump	per ton	£5	..
a	Soda, Caustic (white 70 %) ..	per ton	£10 15	..
a	,, Crystals	per ton	£3	..
a	Sodium Bichromate, casks ..	per lb.	2¼d.	..
a	,, Cyanide	per lb.	7d.	..
	METALS, &c.			
b	Aluminium Ingots, in ton lots ..	per ton	£150	..
b	,, Wire, in ton lots ..	per ton	£177	..
b	,, Sheet, in ton lots ..	per ton	£175	..
b	Babbitt's metal ingots	per ton	£43 to £140	..
c	Brass (rolled metal 2" to 12") basis	per lb.	7⅞d.	⅛d. inc.
c	,, Tube (brazed)	per lb.	9¼d.	..
c	,, ,, (solid drawn)	per lb.	8¾d.	⅛d. inc.
c	,, Wire, basis	per lb.	8d.	⅛d. inc.
c	Copper Tubes (brazed) ..	per lb.	10⅝d.	⅛d. inc.
c	,, ,, (solid drawn) ..	per lb.	11d.	⅛d. inc.
g	Copper Bars (best selected) ..	per ton	£84	..

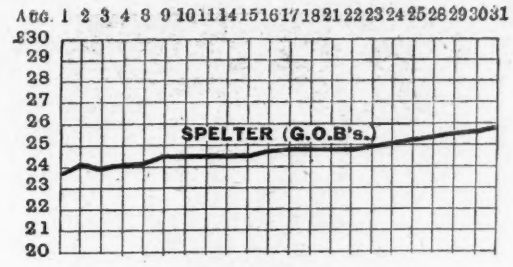
	METALS, &c. *(continued)*.		Latest Price.	Fortnight's Dec. or Inc.
g	Copper Sheet	per ton	£84	..
g	,, Rod	per ton	£84	..
e	,, (Electrolytic) Bars ..	per ton	£74	..
e	,, ,, Sheets ..	per ton	£87	..
e	,, ,, Rod ..	per ton	£81	..
e	,, ,, H.C. Wire	per lb.	9⅝d.	..
	Ebonite Rod	per lb.	3/3	..
	,, Sheet	per lb.	3/-	..
n	German Silver Wire	per lb.	1/6	..
h	Gutta-percha, fine	per lb.	6/- to 7/-	..
h	India-rubber, Para fine	per lb.	5/7 to 5/7½	inc.
i	Iron, Charcoal Sheets	per ton	£18	..
i	,, Pig (Cleveland warrants)	per ton	48/7	1/5 inc.
i	,, Forgings, according to size	per ton	From £11	..
i	,, Scrap, heavy	per ton	47/6 to 50/-	..
i	,, Wire, galvanised No. 8 ..	per ton	£9 15	..
g	Lead, English Ingot	per ton	£14 5 to £14 10	..
g	,, ,, Sheet	per ton	£16	..
m	Manganin Wire No. 28	per lb.	8/-	..
g	Mercury	per bot.	£7 2 6	..
d	Mica (in original cases) small ..	per lb.	6d. to 1/-	..
d	,, ,, ,, medium	per lb.	2/6 to 4/-	..
d	,, ,, ,, large ..	per lb.	4/6 to 8/6	..
p	Phosphor Bronze, plain castings	per lb.	1/1 to 1/3	..
p	,, rolled bars & rods	per lb.	1/1½ to 1/3	..
p	,, ,, strip & sheet	per lb.	1/4	..
o	Platinum	per oz.	84/-	..
e	Silicium Bronze Wire	per lb.	10½d. to 11½d.	..
i	Steel, Magnet, acc'd'g to desc'p'n	per ton	£58	..
i	,, ,, in bars		£15 to £40	..
g	Tin, Block	per ton	£152 to £153	..
n	,, Wire, Nos. 1 to 16	per lb.	1/10	..
p	White Anti-friction Metals— "White Ant" brand ..	per ton	£46 to £70	..
j	Yarns, 2/10s Grey Cotton, on sp'ls	per lb.	8d.	..
j	,, 6 lea. Flax	per lb.	5⅜d.	..
j	,, 3 ply 10 lbs. Russian ..	per lb.	4½d.	..
j	,, 10 lbs. Russian, single ..	per lb.	4¼d.	..
j	,, 180 lbs. Jute rove	per ton	£11	..
k	Zinc, Sh't (Vieille Montagne bnd.)	per ton	£29	..

Quotations supplied by Messrs.:—*a* G. Boor & Co.; *b* The British Aluminium Co., Ltd.; *c* Thos. Bolton & Sons, Ltd.; *d* F. Wiggins & Sons; *e* Frederick Smith & Co.; *f* India-Rubber, G.P. and Teleg. Works Co., Ltd.; *g* James & Shakspeare; *h* Edward Till & Co.; *i* Bolling & Lowe; *j* Walter H. Hindley and Co., Ltd.; *k* Morris Ashby, Ltd.; *m* W. T. Glover & Co., Ltd.; *n* P. Ormiston & Sons; *o* Johnson, Matthey & Co., Ltd.; *p* The Phosphor Bronze Co., Ltd.

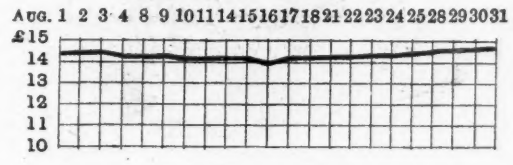
Relative Cost of Gas for Motive Power.—A paper read before the Canadian Society of Civil Engineers recently contains some useful information upon the cost of generating power by means of coal, producer, water and semi-water gas, and by gasolene, or, as it is better known in this country, petrol. The results obtained from a number of engines, running 10 hours a day for 312 days in the year, are as follows:—Petrol:—The consumption of petrol is one-eighth of a gallon per B.H.P.-hour, and at 10d. per gallon the cost per B.H.P. per annum is 325s. Coal gas:—With a gas engine of modern construction taking 15 cb. ft. per hour per B.H.P., the cost per annum per B.H.P., with gas at 4s. 2d. per 1,000 cb. ft., would be 195s. Semi-water gas from anthracite:—With anthracite at 20s. 10d. per ton, and the engine and producer working at 1 lb. of anthracite producing 1 B.H.P-hour, the annual cost of 1 B.H.P. would be 32s. 6d. Semi-water gas from gas-coke:—With an 80-H.P. plant on test, the consumption of common gas-coke was 92 lb. per B.H.P.-hour, and with coke at 16s. 8d. per ton, the cost per annum of 1 B.H.P. would be 24s. Water-gas from bituminous coal:—With reasonably large engines, 1 B.H.P.-hour requires 8 lb., which at 16s. 4d. per ton would show a cost of 20s. 10d. per annum per B.H.P. Of course, with fuel at other prices these costs would vary, but the author makes out a very good case for gas-driven sets when producer gas is used, and gives an interesting curve connecting relative power obtained from various qualities of gas, referred to semi-water gas having 150 B.TH.U. per cubic foot as a standard.

METAL MARKET.

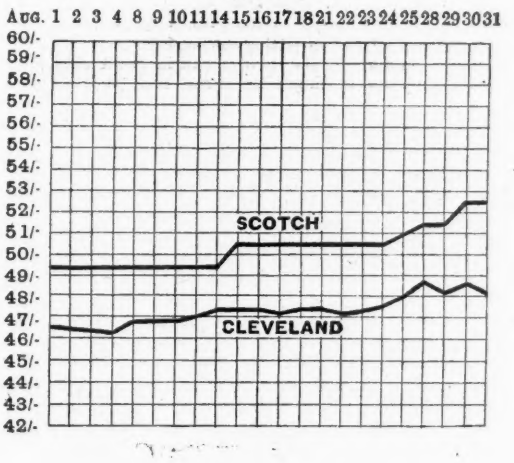
Fluctuations in August.



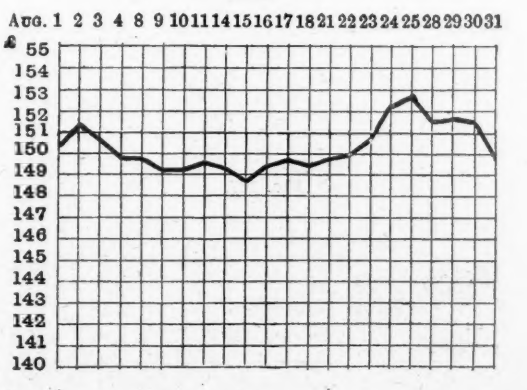
LEAD (ENGLISH).



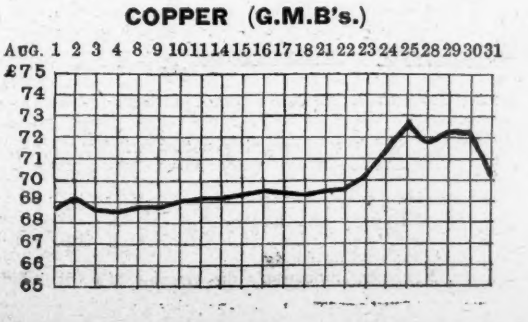
IRON.



TIN.



COPPER (G.M.B's.)



ELECTRIC TRAMWAY AND RAILWAY EXHIBITION, 1905.

Description of Interesting Exhibits.

(*Concluded from page* 358.)

Switchgear and Instruments.—Perhaps the most noteworthy feature of the show of switches lay in the multitude of circuit-breakers. They were nearly all built on the same lines, but each one deserved minute study to gather the beauties of the varying details. All were fitted with what is now commonly known as the "loose handle," and many had some more or less ingenious time limit device. In traction stations, particularly, both of these refinements are most needful.

The switchgear as a whole was solidly built, and gave us the impression that the day is now past when switches go to pieces in the operator's hand and heat at current-carrying pivots. Circuit-breakers, too, are designed so that they will continue to break heavy currents until further orders, and do not think it dignified to stick and let something else go first after a certain number of actions.

The instruments all seemed built to the same standard of excellence, and some, perhaps, to the same specification. Scales were open and readable from afar, and most were translucent for illumination from the back.

As our space has become very limited, it is not possible to give to the most interesting exhibits in this section the detailed description which they deserve, and which we should like to allot them.

Of Messrs. J. G. Statter & Co.'s articles we illustrate (fig. 102) the remarkably simple time limit attachment for circuit-breakers.

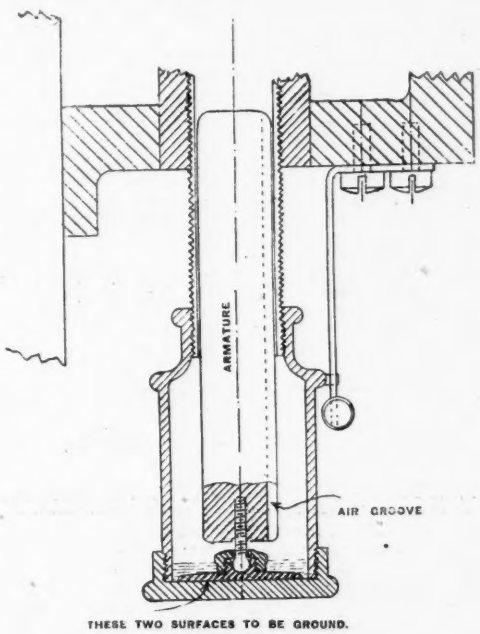


Fig. 102.—Statter Time-limit Device.

The circuit-breaker armature is fitted with a small brass disk on a ball joint. When the current in the tripping solenoid reaches a certain value the armature and disk are drawn up to release the detent, but dashpot action intervenes, first, owing to the immersion of the ground-faced disk in glycerine, and until the overload has been maintained for a pre-determined time interval, the armature does not respond to the pull of the solenoid. Should the load rise dangerously, the action of the armature is instantaneous, as the dashpot action is then negligible as compared with the tractive force of the solenoid.

With this device the difficulty of "floating" of armatures, due to a gradual increase in the load, is very effectively overcome, for when the pull is sufficiently powerful to overcome the "sucker" action, it has attained a force which brings the armature up with a considerable rammer blow against the catch.

Their circuit-breakers are neat and strong, and are fitted with the loose handle which prevents the circuit-breaker from being closed on a short circuit long enough for the ammeter needle to swing over the scale.

Fig. 103 illustrates their automatic battery regulator. A small motor works through a gearing and oscillating arm; arranged just above this arm are two coils connected in series, one of these coils being stationary, and the other balanced so that a rise or fall in the pressure applied across the terminals would cause this coil to be attracted towards, or repelled from, the stationary coil. This throws into gear on the oscillating arm one of two small catches, one being operated when the small coil is repelled, and the other when it is attracted. These catches engage in a notched

wheel which is connected by steel bands to a multiple-way cell regulating switch. This switch is therefore brought up one cell at a time, cutting cells in or out until the voltage is adjusted.

Without touching the special construction of their switchboard

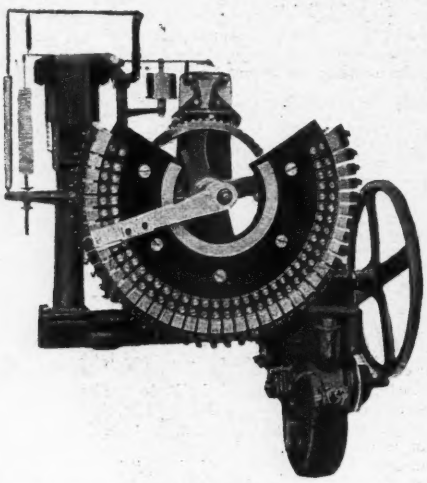


Fig. 103.—Statter Automatic Battery Regulator.

Fig. 104.

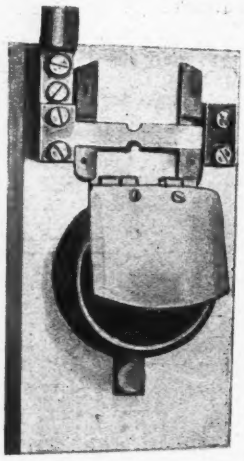


Fig. 105.

frames, we leave Messrs. Statter's stand after illustrating a novel form of magnetic blow-out fuse which needs no explanation. Fig. 104 shows it biding its time, fig. 105 after heroically saving the situation (though our illustration shows the fuse intact!).

Messrs. J. E. Spagnoletti & Co. made their sensation with automatic signalling apparatus, of which we hope to give a detailed description in a later issue. The railway form has been installed on the Great Northern and City Railway and on the Central London, while the tramway variety is now perfected, and was to be seen in operation at the Exhibition.

Figs. 106 and 107 show Spagnoletti's auto-battery regulator.

The action of the apparatus is as follows:—If the voltage of the cells C should fall, the volt balance B_s closes one of two circuits, which allows the current to pass round two relay coils Rc, which, on becoming energised, attract an armature A. This armature is fixed to a pivoted arm Pa. The arm is kept in a vertical position when out of action by means of a spring S, this spring being fastened to one end of a bar B bent in the shape of a U, to the other end of which is fixed a similar arm Pa for the reversal of the switch. These arms are supported on sliding bearings. The centre of this bar is coupled to the axis of a half-throw magnet motor M by means of two links. At the bottom end of the arm a copper brush C makes contact with a brass plate when the arm is drawn over by the energised relay coils Rc. This action causes the half-throw motor M to become energised and starts the half-turn motion. In doing so it raises the U-bar B, but the arm being held over by the relay coils Rc, it engages in a toothed wheel T W fixed to the spindle of the battery regulating switch Bs, and turns the wheel round one notch. This places the brush on the next stud, whereby it puts another cell into circuit. On completing this movement the motor releases a small switch Sm, which breaks the circuit of the motor and allows it to regain its original position. A dash-pot D is fixed to the spindle of the motor to prevent it falling too quickly.

If the voltage rises, a similar action takes place on the other side of the toothed wheel Tw. The volt balance switch Bs makes contact on the other side, this putting into circuit the other two relay

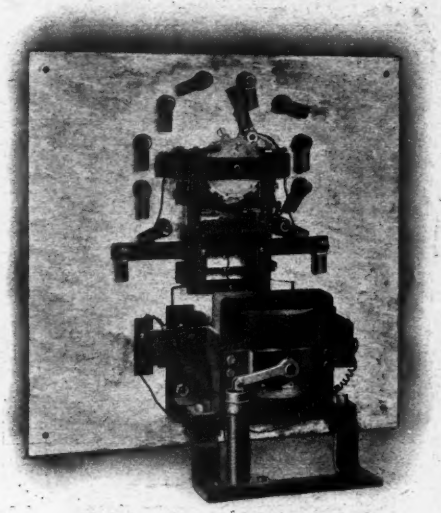


Fig. 106.—Spagnoletti Battery Regulator.

coils R_{c1}. In so doing it attracts the second arm P_{a1}, and engages the toothed wheel on the other side, on which the motor coming into action turns the wheel in the reverse direction, moving the brush back one stud, and so cutting out one cell.

When the regulating cells are either all in or all out, the apparatus is thrown out of circuit by means of a projection on the

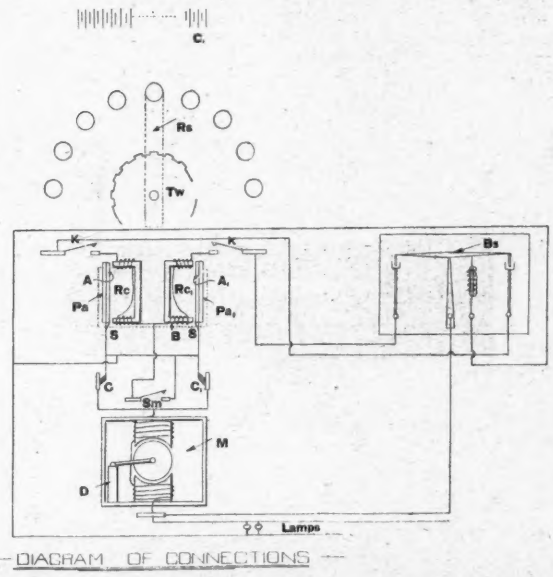


Fig. 107.

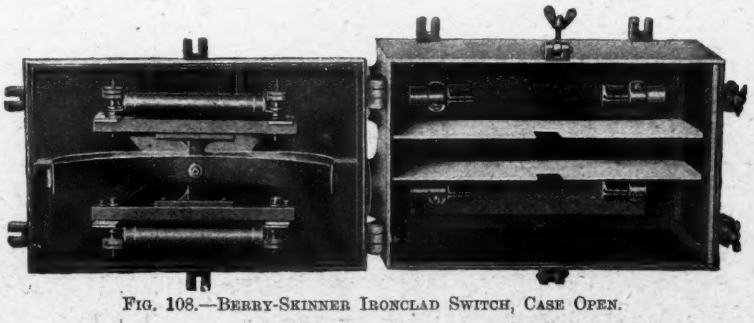


Fig. 108.—Berry-Skinner Ironclad Switch, Case Open.

toothed wheel, which opens a spring contact switch K, thus breaking the motor circuit and saving the motor from banging away unnecessarily.

Messrs. Berry, Skinner & Co. are among the few makers who have complied literally with the requirements of the Home Office with regard to switches for factories and workshops. Figs. 108 and 109 illustrate the novelty clearly.

Messrs. Everett, Edgcumbe's display was of great interest.

Of their inkless recorder we shall treat at length later. It marks a new epoch in recording instruments, and every one who has to do with records, from the youth who covers himself with ink and

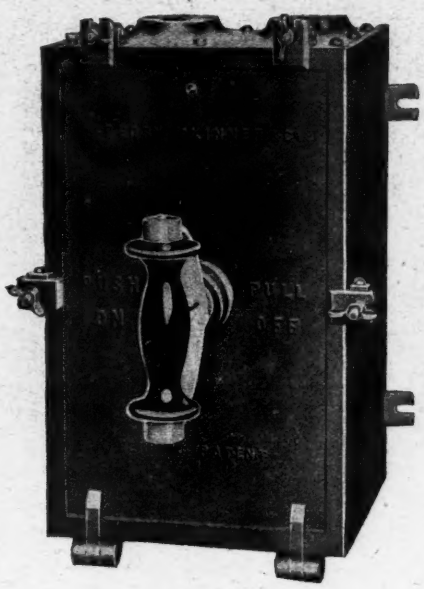


Fig. 109.—Berry-Skinner Switch.

profanity in his efforts to get the pens of the instruments in his charge to draw something between a glorious smudge and an occasional line, to the engineer who ought to read them, will sing a gloria over the new autographer.

Fig. 110 is reproduced from a photograph of the Everett-Edgcumbe portable photometer in position.

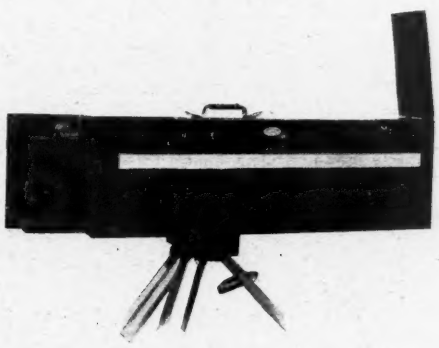


Fig. 110.—Everett-Edgcumbe Street Photometer.

The criticisms and complaints which we hear constantly levelled against the comparative brilliance of electric lamps, either for public or private lighting, can be settled in a twinkling by this

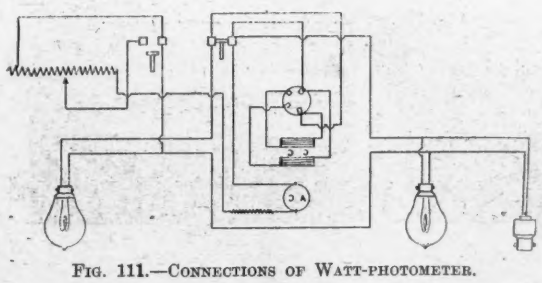


Fig. 111.—Connections of Watt-photometer.

handy arrangement, and it ought to find a place in every supply station.

It embodies the following important points:—

1. A portable electric standard is employed, which can be readily checked at any time, and is worked off a portable accumulator.

2. Lights of various colours can be readily compared.

3. The scale reading has merely to be multiplied by the candle-power of the lamp employed, in order to give the actual illumination on the photometer.

4. The candle-power of the source of light under test is at once obtainable by means of a table from this figure, as is also the illumination on a horizontal plane, should this be required.

The flicker arrangement is a modification of that employed in the Everett-Edgcumbe laboratory photometer for arc lamp testing, and it is especially designed to get over the errors usually found when comparing incandescent electric lamps with arc lamps or incandescent gas.

No previous experience whatever is required in order to use it.

Fig. 111 is the diagram of connections for the same firm's direct-reading watt photometer, by which a single adjustment gives the candle-power, the wattage, and the efficiency of the lamp under

Fig. 112.—Everett-Edgcumbe d.c. Leakage Detector.

test. The candle-power and efficiency of a batch of lamps can be determined in a few minutes in broad daylight, and irrespective of voltage.

The correspondence in our columns on the subject of leakage indicators was sustained and spirited enough to remain in our readers' memories, and we imagine that the instruments on Messrs. Everett, Edgcumbe's stand which brought it about received as much attention as an incubator at a baby show. With the additional advantage of Mr. Kenelm Edgcumbe to show them off, it is not surprising that they created considerable interest. The Home Office regulations make it clear that means must be provided for the immediate localisation of leakage, and that the "means" must be kept in circuit all the time, and must indicate a fault on any main.

Under these circumstances, therefore, it is clear that neither the old-fashioned earth lamps nor the more modern voltmeter graduated in ohms (sometimes spoken of as an "Ohmmeter"), will meet the conditions, which, in fact, cannot be entirely satisfied.

Fig. 112 shows the type of instrument employed for two-wire d.c. insulated systems, and Fig. 113 shows diagrammatically the connections.

When in the normal position, the instrument, which consists of a sensitive moving-coil milliampere meter, is connected to earth from

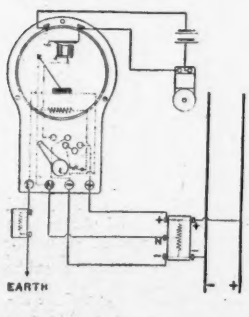


Fig. 113.

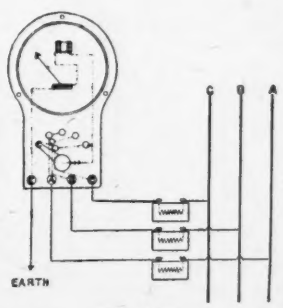


Fig. 114.

the central point of a high resistance joined across the mains. This is the position in which the instrument is left continuously, and so long as the insulation of the two mains is perfect or equal, the pointer will remain at zero in the centre of the scale. The occurrence of an earth on either main is at once shown by a deflection of the pointer towards either the end of the scale marked "+ main faulty" or that marked "— main faulty," as the case may be. A really bad earth causes a relay, contained in the instrument, to close the circuit of a bell or lamp, so as to draw the attention of the attendant to the fact that something is wrong.

It will be seen that the indications so obtained are only relative, and do not allow of the direct measurement of either the leakage current or the actual insulation of the mains.

In order to enable this also to be done, two further steps are

provided, by means of which the instrument can be connected between the positive and negative mains respectively and the earth. Two readings (in milliamperes) are thus obtained and, by means of a specially calculated table, not only the leakage current, but also the insulation resistance of each main can be at once read off.

The table can be used by anyone, but is too large to be reproduced effectively in these columns.

The three-phase instrument is in general design very similar to the direct-current pattern, except that, in place of the two stops "+" and "−," three are provided, one for each phase, A, B and C. The connections are shown in fig. 114, from which it will be seen that, when in the all-day or "normal" position, the instrument is connected between an artificial neutral point and the earth. The occurrence of a fault is at once shown by a deflection of the instrument, and by testing on the A, B and C stops, in rotation, the faulty main can be at once located. It must be remembered that the main giving the *smallest* deflection is the faulty one, while the magnitude of the readings obtained on the other two stops indicates the gravity of the fault. Unfortunately, in the case of three-phase systems, the same accuracy is not possible as is the case with the direct-current indicators. This is owing to the disturbing effects of capacity, &c. However, they comply with the main requirements of the new rules, and are duly accepted by the Home Office authorities.

Messrs. Everett, Edgcumbe & Co., Ltd., are also furnishing sets of instruments for single-phase insulated, and for two-phase four-wire systems, as well as for three-phase and direct current three-wire systems with earthed neutral, and for single-phase with one wire earthed, which last, although recommended by the Home Office, are not compulsory.

Messrs. Kelvin & James White's stand contained their well-known line of marvels in instrument design, but we did not observe anything which is not already within the knowledge of our readers.

We illustrate (fig. 115) only one item from Messrs. Nalder Bros. & Thompson's stand, although there was a complete line of

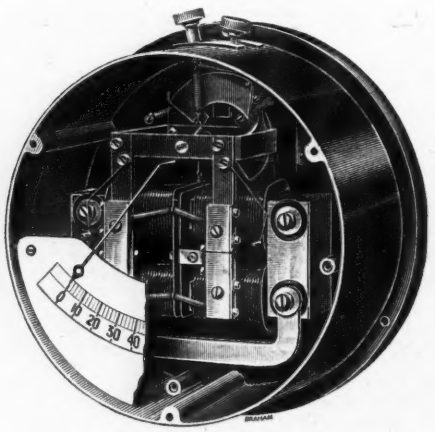


Fig. 115.—Nalder Bros.' New Wattmeter.

measuring instruments on it. It is the new wattmeter invented by Dr. C. V. Drysdale, and presents certain points of novelty.

The instrument consists essentially of four fixed current coils, wound on soft iron cores, arranged to give a very intense field with a very small air-gap. Between the poles of the magnets are two flat coils wound with fine wire, which constitute the pressure coils; these are wound in opposite directions, and as each is arranged to have an equal number of turns, the self-induction of the pressure circuit is practically nil, consequently no correction has to be applied. Of these two pressure coils, the thickness of which is only $\frac{1}{50}$ of an inch, one is fixed and the other is allowed to move vertically in the field produced by the current coils. This vertical motion is transformed into a rotary one by means of a fine wire attached to the coil, which passes over an arbor to which the pointer is attached. To the pointer axis is attached an improved form of air damping which makes the instrument dead-beat.

The advantages of this instrument are:—(1) Owing to the extremely small space taken by the pressure coils the magnet air-gap is very short in length, consequently a very strong field is produced which gives large force in the instrument, and at the same time renders the instrument unaffected by external fields. (2) The coefficient of self-induction of the pressure circuit being negligible, the errors at low power factors are very small; in fact, careful testing on this form of instrument shows that it can be guaranteed to within 1 per cent. with power factors as low as one-tenth.

In addition to the standard instruments which are to be found on every switchboard, Messrs. Elliott Bros. exhibited "Groves's" network ohmmeter (fig. 116) and a leakage indicator to comply with the new mining regulations. The former has been designed for testing the insulation resistance of a complete network without interrupting the supply.

The makers say:—The unreliability of a recording ammeter connected between the neutral main of a three-wire system and "earth," as an indicator of the soundness or otherwise of the insulation of the network under all conditions, is generally recognised. The ammeter readings are differential, and the instrument, moreover, may be shunted by a neutral fault. It is with a view to

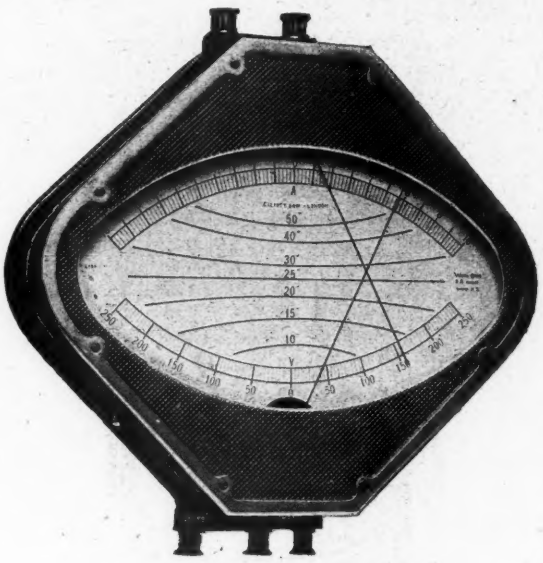


Fig. 116.—Elliott Bros.' Ohmmeter.

correcting this error that this special ohmmeter has been designed by Mr. Groves.

The "Century" testing set needs no bush.

Then there was the new reservoir inking device for recorders, of

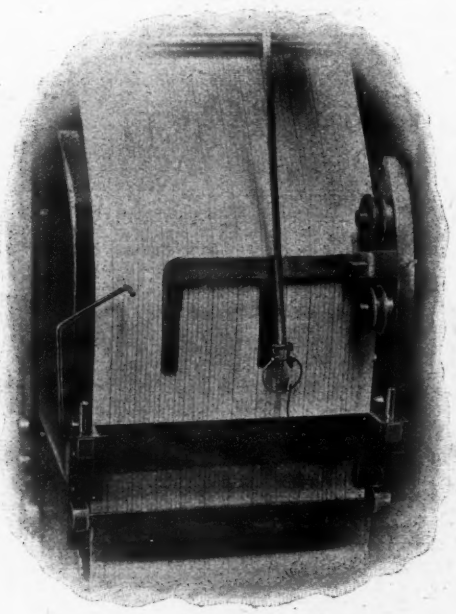


Fig. 117.—Elliott Bros.' Inking Device.

which the figure (fig. 117) gives a view from the life. The pen is a simple capillary siphon with the supply end dipping into an ink-filled trough the width of the scale.

Messrs. R. W. Blackwell & Co. exhibited a representative selection of I.T.E. circuit breakers for all services, the overload pattern being fitted with loose handles.

The Sturtevant Co. made a great display of their "Igranic" starting switches, of which the world has heard by this time, or it is no fault of the makers if it has not. We understand that their starters in one form or another will start anything from a horse-race to a rolling-mill, with one exception, for they will not start a fire.

Messrs. Cowans, Ltd., exhibited by the light of new white-flame arc lamps, for which special results are claimed, as novel a form of motor starter as we have seen, and one which seems to defy criticism.

The resistance is made up of high thermal-capacity box units, any one of which can be quickly replaced by a spare. The first movement of the hand-wheel closes automatically the D.P. enclosed oil-break switch, mounted on the side of the starter, and at the same moment excites the field of the motor. The resistance in series

with the armature is then cut out step by step. If the operator removes his hands from the controlling wheel the D.P. switch immediately opens, and the hand-wheel must be rotated to the first stop before the D.P. switch will close again. In this way the risk of burning out the resistance is obviated. If, in starting up, the operator cuts out the resistance too rapidly, the D.P. circuit breaker will cut off the supply, and the starting operation must be begun again. If the pressure falls below 50 per cent. of the normal, the D.P. circuit breaker automatically disconnects the supply. The arrangement of this starter thus provides that while the resistance in series with the armature can be cut out step by step, it cannot be cut in. It is well known that it is in the cutting-in of the resistance that destructive sparking occurs at the contacts. Messrs. Cowans also exhibited maximum circuit-breakers of the magnetic blow-out type and the Andrews alternating-current discriminating release gear.

The portable watt-hour-meter for use on tramcars must have interested tramway engineers—and, let us hope, non-engineering managers—more than anything else on the Aron Electricity Meter, Ltd., stand. It has the reputation of being a regular knock-

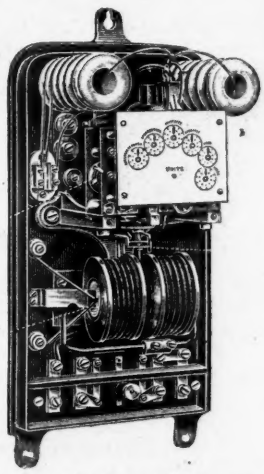


Fig. 118.—Aron Portable Watt-hour-meter.

about, and, like its prototypes, comes up smiling and remains accurate after the most severe thumping that a bad track can administer. Fig. 118 illustrates it.

The ordinary clock meters for use on polyphase circuits, batteries,

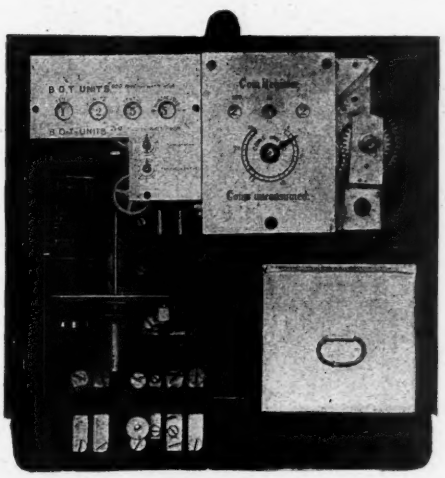


Fig. 119.—Aron Prepayment Meter.

&c., are well known, but the alternating induction motor meter is comparatively new, especially in its combination with the Aron two-rate clock. As a prepayment meter it is illustrated in fig. 119. Double tariff meters are finding more favour now that this system of charging is becoming better known. Fig. 120 shows that it is made by the Aron Co. in the form of a time switch combined with a meter.

Of great interest also is the combined meter and maximum demand indicator, which is a development of the Aron clock meter. The indicator is actuated by the meter itself, and is consequently equally accurate with the meter. It possesses the following advantages:—

1. The scale is equally divided down to zero.
2. Being combined with the meter, only one set of electrical

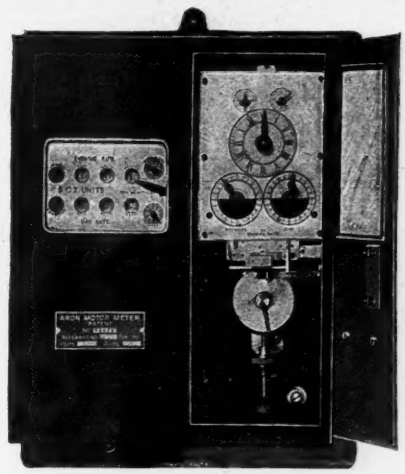


Fig. 120.—Aron Double-tariff Meter.

connections is necessary, and only one piece of apparatus instead of two.

3. The time element, or sluggishness, of the instrument can be varied over a very large range, but is the same for all loads.

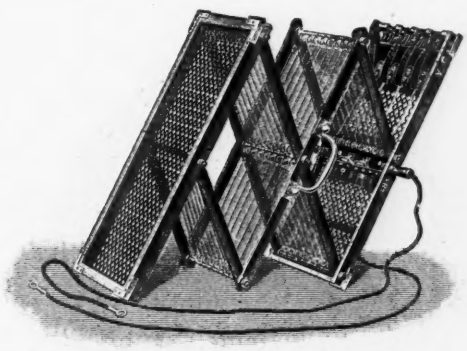


Fig. 121.—Aron Portable Resistance, Open.

4. Its price, especially in the larger sizes, is very much less than that of a meter and a demand indicator separately.

The Aron portable resistance for providing an artificial load

Fig. 122.—Portable Resistance, Closed.

for testing consumers' meters on their own premises is delightfully ingenious. Figs. 121 and 122 show it open and closed.

Messrs. Foxcroft & Duncan were represented excellently by examples of the great range of instruments which they make. Unfortunately, none lend themselves to interesting illustration, and this we regret the more, as the quality of their work is so good that we should not like to be accused of giving it too little attention.

Amalgamation of Italian Electrical Firms.—Following upon the lines of the recent amalgamation of manufacturing firms in Germany, the Electrotechnical Co., of Turin, has joined the firm of Brioschi & Finzi, of Milan, the well-known makers of heavy electrical machinery. The combined capital will be approximately £200,000.

Gas undertakings in Italy seem to be in a bad way. The Turin Co. has asked its shareholders to sanction a reduction of capital from £400,000 to £320,000.

A FABLE IN VARIOUS STYLES.

(COMMUNICATED.)

Once upon a time there was a company which was promoted primarily for stud purposes, to speak in the expressive language of the stable. Such a sire was never before known in Company history if its virtues are to be measured by the numbers of its offspring.

Incidentally the business of the Company and of the little Companies, its sons, was to carry the people to and fro in tramcars.

Having served the main purpose of the Company by being born, it was nevertheless the duty of the Company to maintain its offspring; we will not say the unpalatable duty, at least it was the duty laid down by certain legal enactments which are not altogether in favour of breeding for pleasure only.

Many men are good, punctual husbands, but bad fathers, and is is to be feared that the Company came within this category.

To produce is one thing, to rear another, and to educate a third.

Production, as we have seen, was the Company's forte, but the other two items did not enter into its constitution, except, as the chemists say, as traces.

This was unfortunate for the children.

Paternal instincts do not grow on gooseberry bushes, nor upon the trees which adorn a stock exchange.

The Company thought that, perhaps, much might be learned from manuals for the education of the young, and it set about to learn the wisdom of a thousand parents.

In many ways knowledge can be acquired, but the fruit of learning is the application thereof.

When the paternal instincts are absent, the profoundest learning yields but barrenness.

In a family of many children none are equal. Ages are unequal, talents are unequal, physical strengths are unequal.

Features and garments may bear the family resemblance, especially the garments, but these things do not make equality.

But the Company treated its children equally.

When even treatment is meted out level returns are expected. From children? No, from day labourers.

But the Company expected even returns from its children.

A parent may delegate part of his parental duties to another. Children are educated from the time they leave their mother's arms by these people. Nurses, governesses, tutors, schoolmasters, all should be chosen wisely and paid well.

The Company appointed educational proxies, and some it chose amiss and paid well, and some it chose well and paid ill.

When a child is sickly or deficient in any normal respect, its tutor must be chosen with special care and treated with particular distinction if it is desired that the child be not sickly and deficient all its days.

But the Company, although annoyed at the necessity of rearing children at all, found from its manuals that children may be a source of pleasure to their parents, and it determined to make the best of the circumstances by obtaining pleasure from its children.

To the Company, pleasure and profit were indistinguishable. Both had been derived in great measure from the procreation of children; both should be obtained from their continued life.

The Company overlooked the fact that when children give pleasure to their parents they are healthy, and in course of time they began even to persuade themselves that their children were as healthy as the children of others.

In truth all the children suffered from an incurable disease almost from the day of their birth.

Incurable diseases are often lingering, and are seldom discernible by any but the eye of the physician.

A physician may palliate, though he cannot cure.

Also there are veritable physicians, and there are quacks.

To the man who has an overpowering desire to be well quickly, the physician is a charlatan, but the quack, who promises much and proclaims it aloud above the bang of drums, is well-deserving.

So with the Company and its depressed family; for when the tutors failed to make the children respond to their treatment, the Company blamed them, and said unto them: "Wherefore do ye not obtain results comparable with—nay, better than the results that Company A. and Company B. obtain through their tutors from their children?"

And the tutors answered as it was given unto them to speak. Some spake from their heads and some from their hearts, and others even out of the coverings of their heads.

At that time there was a country called America, and a portion of that country was called in turn the United States.

The Company had heard of this country, and of the trams which ran there, and although it did not believe all that it read in its own manuals for the education of the young, yet it had no doubt at all that the people in the United States spoke and wrote nothing but the truth, and nothing more than a casual acquaintance with the literature of the subject sufficed to prove that, if English tutors could not educate children so that they might be fit to make gold-bricks out of the contents of a water-butt, there were hundreds in the United States who could do that and more.

That much was clear from the papers.

An emissary possessing the requisite knowledge himself, but with too much to do to apply it, was detailed to proceed to the United States in quest of a supply of new tutors.

In due course a ship-load arrived in England, and was distributed amongst the family.

These tutors had been impregnated in the land of their birth with a corrosive substance called hustle. It seems to have been an essence distilled from diseased nerves and the secretions of persons suffering from St. Vitus' dance.

It was believed to be infallible as a cure for backward or stunted children.

It is good to beat a walnut-tree, and it is at least salutary to thrash children.

But the strokes should be tempered with discretion, if not with mercy, and it is unwise to carry correction to the point of extinction of the subject.

Tutors are subject to the rule of their employers; and although it is not necessary that the parent shall be wise with the tutor's wisdom, it is oft-times convenient that he shall be a man of parts.

Now the Company was full of the cunning that served it well—or ill—to overcome the less cunning, but of knowledge to check the doings of its tutors it had but small measure.

So, therefore, when the horde of men from the United States set out to bring the children of the Company into line with other children born in health out of the purity of chaste wedlock, they worked their wills without let.

Then arose to Heaven the feeble wail of squeezed sucklings, and the louder call of the weaned, for the rule of the new tutors was as the rule of that Pharaoh, who demanded a tale of bricks, and gave no straw for their making.

And daily the reports of the children's progress grew brighter, and gradually the old tutors were sent out into the world to look for new pupils.

Who will say how long the human frame will supply energy to the brain without assimilating food?

To this question the Company found the answer.

Slowly, slowly, the records of the children grew worse, and the excuses of the Americans louder, until the Company realised that attenuation had been carried so far that nothing but prompt measures could prevail.

Food therefore was administered, and for a time the sound of the quack was not heard in the land.

Back in the ship went the men from the United States, but back came not the old tutors.

Poor children! Do you still live?

Ormskirk.—The U.D.C. recently applied for a loan to carry out an E.L. scheme in conjunction with the National Electric Construction Co., and the L.G.B. has intimated that as in the case of Wisbech T.C., the sanction of the B. of T. was necessary, and that before this could be obtained further powers must be secured under the E.L. Act of 1882. No definite action has been taken by the Council in the matter.

POWER GAS.

In view of the undoubted future for gas power, it would be desirable that engineers should begin to familiarise themselves with the statistics relating to gas. There are already two distinct schools of thought in respect of the composition desirable for power gas, namely, the hydrogen school and the carbonic oxide school. Pure hydrogen has a calorific capacity of about 53,300 B.TH.U. per lb., whereas carbonic oxide has a capacity of 4,385 units, or about one-twelfth. Their relative density is $\frac{1}{14}$, so that per unit of volume carbonic oxide has a higher heat value than hydrogen. Equal volumes of the gases, in fact, combine with the same volume of oxygen, and therefore produce the same heat, but the available heat from hydrogen is rendered partially latent, and the product of hydrogen has a higher specific heat, which again is balanced by the density difference. Calorifically, the difference is negligible. On what facts do the two schools of thought rely?

To produce non-hydrogenous gas from, say, a coke or anthracite fuel, it is merely necessary to pass air through a thick bed of the fuel in a state of incandescence. The fuel is completely burned to carbon dioxide at the point of air admission, and 14,500 heat units are generated per pound of carbon. The passage of the hot gas through the upper layers of coke causes an absorption of a second atom of carbon, and the gas escapes finally as carbonic oxide, and carriés 10,232 units of potential heat and 4,400 units of sensible heat distributed in the $2\frac{1}{3}$ lb. of gas, which results from each 1 lb. of carbon consumed. The carbonic oxide contains, therefore, a potential heat power of 4,385 B.TH.U. per pound of gas, that is, $\frac{3}{7}$ of 10,232.

The gas producer never works with this perfection. Some of the CO_2 is not converted. Some oxygen gets through the fuel uncombined, and the final gas therefore contains more nitrogen than the chemical minimum: it also contains some CO_2, and owing to the presence of moisture in the fuel it contains a little hydrogen which arises from the decomposition of the moisture, the oxygen being supposed to form CO with the fuel. Wide and shallow producers, in which the fuel is less consolidated than it is in deep producers with their greater depth or burden of fuel, are apt to be less efficient than the latter. At the best the produced gas is not likely to carry a heat potential greater than $\frac{10}{14}\frac{2}{5}$ of the heat value of the fuel, or, say, 70 per cent. The rest of the fuel heat has appeared in the form of temperature. The gas is hot.

The upholders of hydrogen gas aim to produce a gas less sensibly hot, so they blow steam into the producer, and in this way they cool the fire by absorption of heat in the process of splitting up the water vapour. Large percentages of hydrogen may thus be introduced and the proportion of nitrogen is reduced, but though these effects accompany the use of steam, there appears also to be inseparable, an increase of CO_2. The manufacture of hydrogen has not, in fact, been entirely performed by the waste heat of manufacture of carbonic oxide. Some carbon has been sacrificed in order that more hydrogen may be produced.

The net result is, however, a gas of greater calorific capacity per cubic foot, because there is, on the whole, more combustible in it. The gas is much more explosive—that is to say, it burns more quickly and ignites more readily at a lower temperature than the poorer gas containing more carbonic oxide and less hydrogen. This is, however, held to be a fault of the hydrogen-bearing gases, especially in view of the conditions to which, in practice, a gas engine is subject.

The hydrogen gas will not permit of so much compression as will carbonic oxide. Too great a compression causes pre-ignition, and the engine, therefore, loses the advantage of high compression. By reason of the action of the water jacket of a gas engine it is not desirable that prompt and perfect combustion should take place at the dead point. It is better that explosion should follow the piston, so that as combustion proceeds the heat developed shall be directly converted into work rather than into water jacket heat. In all gas engines there is an excess of oxygen taken into the cylinder. Those who advocate the poorer gas say that they can secure the full power of the engine by admitting more gas and reducing the supply of diluent air.

In the Mond system, the gas produced is very rich in hydrogen, owing to the fact that a low temperature of producer is brought about by the use of huge volumes of steam for the purpose of assisting to preserve the nitrogen of the fuel in the form of ammonia.

The Mond and other ammonia-recovery processes can only be commercially adopted on a scale of considerable size.

For small power work the suction gas producer is much employed. In this apparatus the air is drawn into the producer by the engine itself, and the producer is started up by the aid of a fan, or by a by-pass, to a chimney draught. When once established making gas, the engine is started and the producer closed, except to the engine and the inlet from the atmosphere.

There remains to be considered blast-furnace gas. The blast furnace is simply a very tall producer, heavily blown, and producing a gas containing about 27 per cent. of carbonic oxide and about 3 to 5 per cent. of hydrogen, which is about the desirable quantity that helps to spread ignition throughout the cylinder at a convenient velocity.

From the introduction of lime and iron ore into the furnace, the gas is full of dust and steam, and it must be cooled to get rid of the latter, and washed and filtered through water screens and sawdust to get rid of the dust. This gas is being largely used in Belgium and in Germany for power purposes, and it is an ideal gas for use in gas engines, being capable of bearing a high degree of compression. It is therefore much safer than the hydrogenous producer gases.

To the list might be added the coke-oven gases, which are the complement of the coke-made producer gas, and consist of the volatile constituents of bituminous coal. Coke-oven gas is, therefore, a powerful hydrogenous tar-bearing gas of the illuminating gas order, and, therefore, more suitable for use in small than in large engines, in which its compression must be kept down to safe limits, in order to guard against pre-ignition.

Different gas producers embody some one or other of the ideas above recounted. Perfect working is aimed at by such an arrangement of air entrance grate as will best conduce to the flow of the air and the gas, into which it is at once more or less converted, through the body of the fuel. The tendency to-day is towards high producers, in which the fuel can settle down under the superincumbent load. For bituminous fuel, producers are made duplex, with provision for passing the volatile gases through the incandescent coke, so as to fix them by conversion to stable gases. Certain well-defined principles underlie the action of all, and engineers would do well to become acquainted with the thermo-chemistry of producer gas, so as to be able readily to calculate for themselves the economy of any particular method or process.

B.

PROTECTION AGAINST POTENTIAL RISES IN TRANSMISSION SYSTEMS.

It is well known that in the operation of extra high potential systems of distribution of electrical energy, certain conditions tend to the production of dangerous rises in the potential of parts of the system. In order that these may be rendered harmless, it is essential that adequate means be provided to relieve the strain thus thrown on the insulation of the circuit, both as regards transmission lines and machinery.

M. M. E. Dusaugey, in a paper read before the Société Internationale des Electriciens, discusses the types of apparatus now in use by various Continental companies for this purpose on systems working up to 30,000 volts. As predisposing causes to pressure rises, he mentions (*a*) Atmospheric influences; (*b*) Resonance; (*c*) A sudden break in the circuit; (*d*) Accidental contact with other systems at a higher pressure. The author divides protective devices into two classes: (1) Intermittent; (2) Continuous. Those in the former class are designed to give a momentary discharge to earth by way of a suitable arrangement of spark gaps, having means provided for destroying the resultant arc, and a limiting resistance in the path of the discharge. The second class includes high resistances of liquid or metal wire always in circuit and arranged to pass any excess voltage to earth. These give a continual energy loss, and are known as "overvoltage dischargers." The location of such apparatus cannot always be determined originally, but as a general rule protective devices are placed at the entrance and exit of lines to and from sub-stations and power stations, and at the junctions

of underground lines with overhead trunks. Other devices are added subsequently at such places as are found necessary.

The author proceeds to describe several devices in use. In one case (Société d'Energie Electrique du Littoral Méditerranéan) lightning arresters are arranged with 16 air gaps in series for 10,000 volts, each gap being 1·25 mm., and having eight carbon resistances of 250 ohms each, arranged in series to earth. For 30,000 volts, 48 gaps and resistances totalling 8,000 ohms, are in use. As an "over-voltage discharger" the same company uses nine air-gaps of 1·5 mm. in series, with 10,000 ohms resistance in three sets arranged in △ between the wires. Lightning arresters of the horn and magnetic blow-out types are also in use. When used as lightning arresters by the Société d'Energie Electrique de Grenoble et Voiron, a resistance of 8,000 ohms (wet sand) to earth and one air-gap of 7 mm. are in combination for 15,000 volts. The same horn arresters, when connected as over-voltage dischargers, have 14,000 to 15,000 ohms in series. Another company (Société Hydro-électrique de Vizille) uses earthenware tubes filled with water as limiting resistances. These are 80 cms. long for 10,000 volts. Still another company (Cie Vaudoise des Forces Motrices des Lacs de Joux et de l'Orbe) arranges for a jet of water from a tank to fall into a metal cup connected to the earthed plate of a horn arrester. The water flows from these cups into a second tank kept at earth potential. A modification of this device (Société Hydro-électrique de Guiers) used as an over-voltage discharger, is an arrangement of three water jets from an earthed iron pipe, playing on terminal plates connected one to each line.

The author concludes with the following suggested arrangement of protective devices:—Outside the station, protected from the weather, lightning arresters, of either the horn or magnetic blow-out type, are connected between each line and earth. Between this and the station, spark gaps are arranged in series between each wire and earth (by way of a high resistance) to act as an over-voltage discharger; this is arranged to operate at 50 per cent. excess pressure. Inside the station a continuous discharge of 0·2 to 0·5 of an ampere takes place by way of a high resistance to earth. Between this and the E.H.T. switches kicking coils are inserted, and again between the switches and machines similar kicking coils. Still another discharger of horn arresters and non-inductive resistances is connected in △ between the switches and machine kicking coils.

That we still have much to learn with regard to the running of these high potential systems seems to be admitted by the author by his elaborate precautions against accident.

NEW PATENTS APPLIED FOR.

Compiled expressly for this journal by W. P. Thompson & Co., Electrical Patent Agents, 322, High Holborn, London, W.C., and at Liverpool, to whom all inquiries should be addressed.

16,864. "A new or improved apparatus for electrically controlling the starting and stopping of air-compressing plants for lifting beer and other liquids, also applicable for other purposes." R. Anderson and W. T. Bostock. August 21st.

16,891. "Improvements in electric heating apparatus." C. McIntyre and A. U. Alcock. August 21st.

16,905. "Improvements in and relating to electric alternating current machines." P. A. J. Lafeyrade. (Date applied for under Patents Act, 1901, August 23rd, 1904, being date of application in France.) August 21st. (Complete.)

16,936. "Improvements in the electrolytic manufacture of copper wire strip or the like." S. O. Cowper-Coles. August 21st.

16,943. "Improvements in and relating to electric resistances." The British Thomson-Houston Co., Ltd. (The General Electric Co., United States.) August 21st.

16,945. "Improvements in or relating to apparatus for automatically lighting and extinguishing electric lamps of a circuit at certain hours varying with the seasons." E. Capt-Lecoultre. (Date applied for under Patents Act, 1901, September 3rd, 1904, being date of application in Switzerland.) August 21st. (Complete.)

16,971. "Improvements in, or in and relating to, commutators of dynamo-electric machines and electric motors." W. Armistead. August 22nd. (Complete.)

16,983. "Improvements in magnetic trembler sparking plugs for electric ignition of gases." R. Kennedy. August 22nd.

17,032. "Improvements in electrically-operated fans." W. P. Thompson. (The firm of Reiss & Klemm, Germany.) August 22nd. (Complete.)

17,043. "Improvements in electric alarm apparatus." W. Ashburn and W. B. Ashburn. August 23rd.

17,050. "Improvements in the distribution of electricity on the overhead wire system." J. Robson. August 23rd.

17,079. "Improvements in and relating to receivers for electric waves." F. Schneider. August 23rd. (Complete.)

17,084. "Improvements in and relating to electric train lighting systems." Siemens Schuckert Werke, G.m.b.H. (Date applied for under Patents Act, 1901, August 25th, 1904, being date of application in Germany.) August 23rd. (Complete.)

17,091. "Improvements in audible electric signalling apparatus." W. D. Kilroy, S. Eversheb and Eversheb & Vignoles, Ltd. August 23rd.

17,093. "Improvements relating to magnets for electrical measuring apparatus." J. Herman. August 23rd.

17,106. "Improvements in or connected with arc lamps." E. R. Grote and M. V. Ely. August 23rd.

17,107. "Improvements in or connected with enclosed arc lamps." E. R. Grote and M. V. Ely. August 23rd.

17,133. "An improved life-guard to be attached and driven forward for electric tramcars, steam cars, engines, or any other locomotive driven on roads, rails or metals." J. S. Bailey. August 24th.

17,181. "Improvements in thermo-electric couplers." The British Thomson-Houston Co., Ltd. (The General Electric Co., United States., August 24th. (Complete.)

17,183. "Improvements in and relating to mercurial vapour electric lamps." J. Skwirsky and F. Harrison. August 25th.

17,204. "Improvements in dynamo-electric generators and motors." F. Johnston. August 25th.

17,222. "Improvements in electrical transformers for measuring apparatus and the like." C. Olivetti and D. Gatta. (Date applied for under Patents Act, 1901, August 25th, 1904, being date of application in Italy.) August 25th. (Complete.)

17,223. "Wireless telegraphy." W. Harrison. (Date applied for under Patents Act, 1901, August 26th, 1904, being date of application in United States.) August 25th. (Complete.)

17,235. "Improved construction of appliances for producing electric light displays." A. E. Dakhyl, A. Galanti and H. N. Dakhyl. August 25th.

17,238. "Improvements in electrodes for secondary batteries." H. F. Joel. August 25th.

17,243. "Improvements in electricity meters." H. Aron. August 25th. (Complete.)

17,260. "An electric indicator for showing at a distance the rise and fall of liquids in reservoirs and the like." W. J. Blenheim. August 26th.

17,270. "Improvements in or connected with electrical hand lamps." C. G. Napier-Clavering." August 26th.

17,283. "Improvements in or applicable to automatic breakers for electrical apparatus." H. Moorhouse. August 26th.

17,302. "Improvements in or relating to telephone or like transmitters." H. A. Cutmore and The Telaupod Syndicate, Ltd. August 26th. (Complete.)

17,308. "A new or improved apparatus for producing electrical discharges." H. J. Haddan. (The Synchronous Static Co., United States.) August 26th. (Complete.)

17,312. "Improvements relating to telegraphic signalling systems." G. Bogni. (Date applied for under Patents Acts, 1901, August 31st, 1904, being date of application in Italy.) August 26th. (Complete.)

17,314. "Improvements in automatic regulators for electric currents." P. Kennedy. (Date applied for under Patents Act, 1901, November 12th, 1904, being date of application in United States.) August 26th. (Complete.)

PUBLISHED SPECIFICATIONS.

Copies of any of these Specifications may be obtained of Messrs. W. P. Thompson & Co., 322, High Holborn, W.C., and at Liverpool, price, post free, 9d. (in stamps).

1904.

Electric Traction Systems. de Kando. (Rights under Patent, &c., Act, 1901, not granted.) 14,239. June 23rd.

Electrical Fire Alarms or Thermo-Indicators. Cyon. 14,847. July 1st.

Automatic Telegraphic Apparatus. Damaskinos. 14,918. July 2nd.

Telemeter, Applicable also as a Clinometer or Level and for other Uses. Rule and Liles. 14,694. June 30th.

Electrical Measuring Instruments. Still. 14,728. June 30th.

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Manufacture of Electrical Resistances. Electric Equipment & Securities, Ltd., and Ruzicka. 16,422. July 25th.

Manufacture of Electrical Resistances. Electric Equipment & Securities, Ltd., and Ruzicka. 16,423. July 25th.

Manufacture of Electric Incandescence Bodies. Electric Equipment and Securities, Ltd., and Ruzicka. 16,425. July 25th.

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Telephone Transmitters. Gail. 7,508. April 8th.

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Vapour Electric Apparatus. Ferguson. (Date applied for under International Convention, January 18th, 1904.) 955. January 17th.

Apparatus for Regulating Variable Ratio Electric Transformers. Lydall. 1,874. January 31st.

Apparatus for Controlling Electric Motors. Barr. (Date applied for under International Convention, March 7th, 1904.) 3,195. February 15th.